SORGHUMS
SURE MONEY CROPS

BY T·A·BORMAN

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T. A. BORMAN

SORGHUMS
SURE MONEY CROPS

By

T. A. BORMAN
Editor KANSAS FARMER

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DEDICATION

TO THOSE farmers of the sorghum belt whose efforts at growing wheat and corn have failed to bring them the prosperity and permanency they expected and deserved; to those farmers of the sorghum belt who, with sorghums and live stock, have demonstrated the possibilities for profitable farming and the building of permanent homesteads; and to my father, one of Kansas' first and most persistent growers of kafir and cane, this book is dedicated.

JUN 15 1914

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PREFACE

THIS book is designed to induce a greater appreciation of the grain sorghums to the end that a greater dependence may be placed thereupon for grain and forage. For the sorghum belt farmer it is intended to reveal (1) why he should grow more sorghums, (2) how to maintain and develop their usefulness, and (3) how to make the most money from them.

I have endeavored to make the book interesting to the farm reader, and so have set aside much data of a statistical and scientific character to admit material better understood and obtained in the field and from letters of hundreds of farm correspondents. Also, while putting the material together I endeavored to forget that it was to be made into a book and so, if possible, escape the severe formality which, in so many agricultural books, prevents the reader from meeting the writer on common ground.

I am indebted to scores of farmers, feeders and investigators, from whom I obtained data, figures, photographs, etc., and also from whom I received the encouragement which was the compelling incentive to complete the work.

I confidently believe that a careful reading of what is herein printed and an observance of the recommendations presented, will aid in the development of a more prosperous agriculture throughout the sorghum belt.

Topeka, Kansas.

J. A. Borman

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THE LAND OF GRAIN SORGHUMS

The grain sorghum belt is so named because it is an area to which the sorghums have proven themselves better adapted to the farmers' need for grain and forage than any other crops now known and so are more generally grown than in any other section of the United States. It is an area in which a profitable and permanent type of general farming has not yet become fixed. This is so because the conditions of soil and climate are so different from those with which its settlers were formerly familiar that they have not yet adjusted themselves to a system of farming which insures a permanent prosperity. No locality or country can be a fit place for general farming unless its lands will provide through intelligent cultivation, average good management and reasonable frugality, comfortable homes and a contented people. It is my belief that the dependence upon the early maturing and dry weather resisting grain sorghums, with live stock to consume the grains and roughages of these, will for the sorghum belt farmer build permanently prosperous homesteads.

The Need for Adapted Crops. The greater proportion of the early settlers of the sorghum belt came from Indiana, Illinois and Ohio, and even farther East. They planted the seed of those crops they grew at home—wheat and corn. These crops on the new farms were not dependable. With them there were too many "off" years. The short crop years came when the granaries were already near empty. There was no reserve upon which to draw. In my judgment, farming is poorly done in any locality or country when a single "off" year seriously affects the stability of the farmer. To guard against the usual seriously depressing results of the un-

avoidable "off" year, should be the first effort of every farmer.

However, the watchful eye of the Federal Department of Agriculture was on the sorghum belt farmer. The department knew of the failure of wheat and corn as crops to be depended upon, and sought to locate adapted varieties of these and other crops. The importation of seed of winter wheat from the steppes of Russia, improved the outlook for success through wheat. Later the department introduced the grain sorghums from the dry, hot regions of Africa, and so well have these deported themselves that they have in twenty years given the grain sorghum belt its name as well as its hope.

Providence has provided a useful crop for every region —usually the place does not find the adapted crop until after a considerable time, but sooner or later the two will come together. Man sometimes thinks he knows better than the Maker of things—eventually he will discover his mistake. The farmer who attempts to grow crops to which his soil and climate are not adapted, will fail. For this reason adapted crops only will prevail in the sorghum belt.

Will Again Grow and Fatten Live Stock. Not so many years ago the sorghum belt was an important live stock country—it was the cattle country of twenty-five years ago. In those days countless thousands of cattle roamed its prairies and grew fat upon its grasses. Later it was fenced into ranches. Since has come the settler—the farmer who sought his livelihood and hoped for plenty as a quarter or half section farmer. The meat eater of the consuming center has, since the advent of the settler, been much abusing him for cutting off the source of his cheap meat. Many settlers having failed at farming, have cursed the country and moved back East. But, as the years passed, a better understanding of those uses to which the prairies could be put, dawned upon a farmer here and there, and he built a permanent home and bank account.

I have met hundreds of sorghum belt farmers—these not so widely scattered as might seem—who have said, "This country has treated me well and I have no complaint." In most such instances the realization of this satisfaction and the inspiration of this contentment was live stock—usually cattle—and if the sorghum belt ever becomes a home for the two million or more quarter section farmers it can accommodate, it will be through the grain sorghums and live stock. God made the sorghum belt a cattle country when he placed the buffalo thereon. This should have been sufficient suggestion to the settler that it was the habitat of cattle. Also that whatever he did, through live stock as a basis, must come the hope for his permanency. But, this section will again be a cattle country—through the use of the sorghums and the silo.

The Sorghum Belt Boundaries. The grain sorghum belt, as set down in the literature of the day, is a portion of that wide stretch of high, dry, rolling prairies extending south from the Canadian line to the border of Mexico and from the 98th meridian of longitude on the east, to the Rocky Mountains on the west. The south half of this region is the grain sorghum belt, being approximately four hundred miles wide and a thousand miles long. Mention of the 98th meridian suggests only a vague idea of an imaginary line somewhere, and that its location is of little importance. I will often refer to it and the reader should remember that it passes through or near Beloit, Hutchinson, and Anthony, in Kansas; Enid, El Reno and Chickasha, in Oklahoma; and Austin, Fort Worth and Corpus Christi, in Texas. West of these points and extending to the Rocky Mountains and south of the Kansas-Nebraska line to the border of Mexico, is the sorghum belt. This, then, includes the western half of Kansas, the western third of Oklahoma, the western half of Texas, and all that part of New Mexico and Colorado east of the Rocky Mountains.

Grain Sorghums Essential East of Meridian 98. It

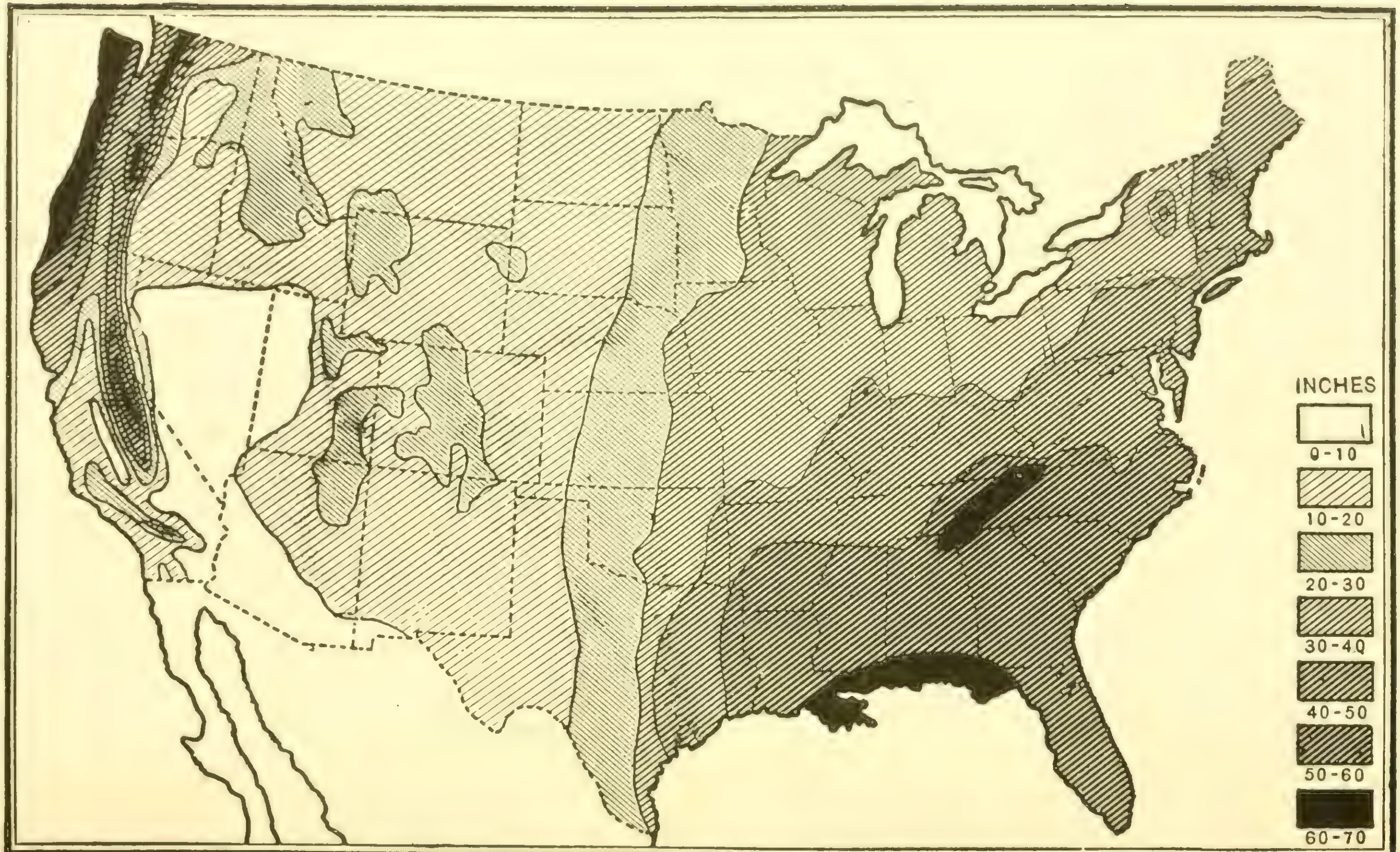
is not to be understood that the eastern boundary of the grain sorghum belt is arbitrary. Indeed, the 98th meridian is not the eastern limit of the area to which grain sorghums are adapted or should be used in the scheme of the most profitable and permanent general farming. In Kansas, almost one-half of the state's total kafir crop is grown east of the 98th meridian, and extending to the 95th meridian. In actual Kansas farm practice the usefulness of sorghum crops extends from the boundary line on the west across the state to the eastern tier of counties. In reality, the sorghum belt extends 160 miles east of the line set down as its limit and in which belt the humid section of the east gradually loses itself in the semi-arid section farther west.

The cultivated uplands of this 160-mile strip across Kansas are recognized by good farmers as being better adapted to kafir and milo than to corn, as "sure feed crops." In other words, Kansas farmers have marked only the most fertile lowlands—river and creek bottoms—as those best adapted to corn, while the thin, high and rolling lands are recognized as sorghum lands. It is my conviction that uplands east of the 98th meridian and west of the 95th, in Kansas, should be planted to grain sorghums. On such lands either kafir or milo in a ten-year period will not only outyield corn but will convert the uncertainty of a corn crop into an almost assured grain sorghum crop. The grain sorghums increase their acre yield of grain and forage tonnage in the proportion that the rainfall is greater and the soil more fertile. Kafir planted on the best of lands, under the most favorable conditions, is in bushel yield and acre tonnage a near competitor of corn in the best years, and in the "off" year excels corn. From this standpoint, therefore, in so far as Kansas is concerned, the sorghum belt may properly be said to include the entire state.

That section of Oklahoma and Texas lying between the 95th and 98th meridians has conditions of soil, climate and rainfall similar to those existing between

those meridians in Kansas, and in this section for each of the two states, grain sorghums can displace corn on the uplands with great advantage. While the areas best adapted to the various grain sorghums are discussed in detail later, it will add to the understanding at this point to say that the kafirs will accomplish most for the grower in sections having 25 or more inches of rainfall, and the milos where the rainfall is less than 25 inches. On the uplands of Kansas, Oklahoma and Texas, between the 98th and 95th meridians, the kafir and milo acreage can at once be profitably increased in the proportion that the grain and roughage can be fed on the farm and later to the extent that the cash market therefor may be developed. It is certain that the grains of the sorghums will rapidly become a commodity of commerce and that soon they will be as readily sold in the markets of the country as is corn. When the maximum feed supply is required and the greatest certainty of such supply is desired, the grain sorghums are superior to corn in a belt at least 160 miles wide across Kansas, Oklahoma and Texas, and at least that far east of the generally considered sorghum belt limit.

Rainfall, Climate and Soil. The average annual rainfall in the sorghum belt west of the 98th meridian varies from 15 to 25 inches, the eastern side receiving the heavier rainfall and the moisture decreasing westward. Three-fourths of this falls during April to September inclusive, this being the growing season. The rains generally are torrential—that is, falling rapidly and so largely running off, unless the soil is so handled as to reduce the escaping water to a minimum. The area is subjected to protracted high winds and fairly high summer temperatures, resulting in rapid and continuous evaporation during the growing season. With the limited rainfall exists an unusual combination of moisture-dissipating forces, and to offset this requires methods of soil handling the purposes of which are to store as well as to conserve moisture.



Map Showing Mean Annual Rainfall of the United States. From Brigham's Commercial Geography.

The altitude ranges from 6,500 feet in Elbert and El Paso counties, Colorado, to 1,500 feet at the 98th meridian on the east. From the point of greatest altitude there is a gentle slope west to the foot of the mountains, reaching 4,000 to 5,000 feet at their base, and also from the point of highest altitude the area slopes gently to the north and south, reaching an elevation varying from 1,500 to 2,000 feet on the southern boundary. Throughout the sorghum belt the nights are generally cool. In the northwestern portion the growing season is comparatively short, killing frosts occurring late in the spring and early in the fall.

The character of sorghum belt soils varies greatly, but practically every soil has been proven as adapted to sorghum growing. The sorghums yield well on the red clays of Central and Western Oklahoma, on the dark clays of the Texas Panhandle, and on the very sandy soils of Northwest Oklahoma and Southwest Kansas. However, the dark, sandy loams which are the prevailing soils of the sorghum belt, give the best cropping results. Sorghum belt soils, generally, have a deep, uniform subsoil which permits the storage of water, and this is a prevailing condition highly encouraging for the success of the crop-growing settler.

"All in all," says Widstoe, "the composition of arid soils is much more favorable to plant growth than that of humid soils." Just why this is so, is a story too long to here relate. In the soils of the arid sections has been placed a large amount of fertility, which, with a small amount of water, can be utilized by the plant to the greatest possible advantage. The sorghum belt farmer must accept these soils as they now are, determined to make the best of them, and feeling that Providence has endowed them with superior qualities which in a measure offset light rainfall. To be sure, the sorghum belt farmer can improve the physical condition of soils by proper handling and can likewise increase the moisture-holding capacity and crop-producing ability. In every instance

Providence has left a few things to be done by man, but he who most intelligently takes advantage of Nature's offerings will succeed in the greatest measure.

Is Rainfall Sufficient to Produce Crops? It is the deficiency of moisture which, in fact, characterizes the sorghum belt from the corn belt. The sorghum belt farmer may properly inquire whether or not the rainfall he may reasonably expect as indicated by the records of the annual precipitation for his locality, will produce profitable grain and dependable feed crops. He has observed that the amount of water required varies with the different plants, also that some plants are capable of obtaining from the soil more water and so make greater and more certain growth than other plants. He has observed, too, that not all the water falling on the land is absorbed, also that no method of handling soils has yet been devised by which it is possible to conserve for the use of the growing plant all the water taken up by the soil.

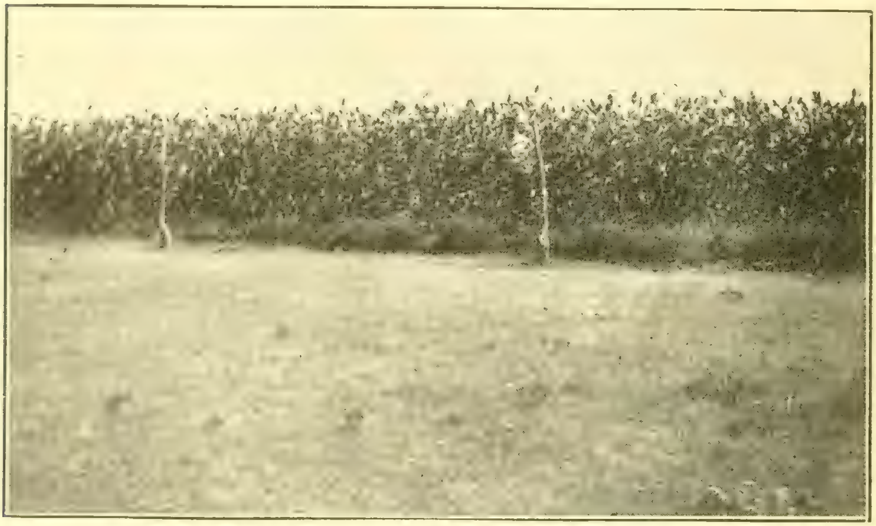
In short, the sorghum belt farmer must have long since realized that his method of using precipitation is tremendously wasteful. He is interested, then, in knowing whether or not he can pursue such methods of soil handling as will enable him to convert a greater part of the rainfall to his use. That he may use more of the precipitation is not a matter of further doubt. What he may expect through the use of practical methods of conservation is recorded by Widstoe, president of the Utah Agricultural College, in his book, "Dry-Farming." He says: "Experience has already demonstrated that wherever the annual precipitation is above 15 inches, there is no need of crop failures, if the soils are suitable and the methods of dry-farming are correctly employed. With an annual precipitation of 10 to 15 inches, there need be very few failures if proper cultural precautions are taken." Widstoe is a foremost investigator of dry-farming possibilities, and his quoted statement holds much hope for sorghum belt farmers. It is certain that

dry-farming has in actual farm practice accomplished sufficient to prove its principles as sound; however, the reader must understand that it is not a panacea for all the difficulties attendant upon a region of light rainfall.

Cannot Escape Dry-Farming Methods. It is not my purpose to here discuss the subject of "dry-farming." However, it is an important topic for the consideration of every sorghum belt farmer. Kansans and Oklahomans in particular dislike the term, "dry-farming"; they feel that to apply it to the farming of their neighborhoods or states reflects discredit thereupon. While the term is a misnomer, nevertheless it is the best we have to express a particular type of soil cultural methods adapted to sections having an annual rainfall of 20 inches or less. To sections having 30 inches of annual rainfall, but affected by winds and high temperatures, dry-farming also applies. Considerable portions of Kansas, Oklahoma and Texas are within these limits, and the farmers of these sections cannot escape dry-farming methods. The Eastern Colorado, Eastern New Mexico and extreme Western Texas farmer has accepted dry-farming more generally than farmers farther east. Generally speaking, it is my opinion that the Eastern Colorado farmer is more permanent than the Western Kansas farmer, because he follows dry-farming methods to a greater extent. It should be remembered that dry-farming is a topic of world-wide concern and farmers of the Great Plains are not alone in the evolution of farming methods adapted to light rainfall. Dry-farming is a "world problem," as will be realized when it is understood that six-tenths of the world's surface has an annual rainfall of 20 inches or less. Many times herein will reference be made to dry-farming practices, but in such way as will enable the reader to distinguish them from common farm cultural methods. Suffice it now to say that the sorghum belt farmer must give heed to dry-farming ideas and by exercising care in their execution can greatly increase both

surety and profitableness of those crops best adapted to his conditions.

Farmer Held Responsible for Drouths. "Drouth may be defined as a condition under which crops fail to mature because of an insufficient supply of water," says Widstoe. "Providence has generally been charged with causing drouths, but under the above definition man is



Upland Milo Field, 1911, at Dodge City Branch Experiment Station. Observe Native Vegetation in Foreground.

usually the cause. Occasionally, relatively dry years occur, but they are seldom dry enough to cause crop failures if proper methods of farming have been practiced. There are four chief causes of drouth: (1) Improper or careless preparation of the soil; (2) failure to store the natural precipitation in the soil; (3) failure to apply proper cultural methods for keeping the moisture in the soil until needed by plants, and (4) sowing too much seed for the available moisture." Widstoe says further: "A fairly accurate knowledge of the climatic conditions of the district, a good understanding of the principles of agriculture without irrigation under a low rainfall, and

a vigorous application of these principles as adapted to the local climatic conditions will make dry-farm failures a rarity.

"All evidence at hand shows that a large portion of the precipitation falling upon properly prepared soil—whether it be in summer or winter—is stored in the soil until evaporation is allowed to withdraw it," says Widstoe. "* * * It must be said, however, that the possibility of storing water in the soil—that is, making the water descend to relatively great soil depths away from the immediate and direct action of the sunshine and winds—is the most fundamental principle in dry-farming."

Evaporation of Moisture From Soil. To prevent evaporation of moisture from the soil is a matter of as great importance as storing it. Over a large part of the sorghum belt the loss of moisture by evaporation is tremendous. The average evaporation from a tank during the months of April to September, inclusive, at Akron, Colorado, for the years 1908-1909, was 45 inches; Hays, Kansas, 1907-1909, 45.2 inches; Garden City, Kansas, 1908-1909, 59.9 inches; Amarillo, Texas, 1907-1909, 52.4 inches; and at Dalhart, Texas, 1908-1909, 54.6 inches. These are figures of comparative value only and show the amount of evaporation under the most favorable conditions. The evaporation from the soil under the same conditions is very much smaller, although governed largely by the character of soil. Cultivation in California, as shown by Fortier, reduced evaporation from the soil surface 55 per cent. At the Utah Station cultivation saved 63 per cent on a clay soil, 34 per cent on a coarse sand, and 13 per cent on a clay loam. The depth of the cultivation resulting as above is not recorded. However, it seems that the deeper the surface mulch the more effective it is. For instance, Fortier found that in 15 days a piece of irrigated land lost by evaporation one-fourth of the water used, while a 4-inch mulch saved 72

per cent of it, an 8-inch mulch 88 per cent, and a 10-inch mulch stopped evaporation.

It appears that cultivation is a much more effective means of evaporation control than sorghum belt farmers generally—as evidenced by their practice—have believed. Those who have recognized the necessity of controlling evaporation have so attempted only during the crop-

Feterita Yielding 30 Bushels per Acre in 1913, at Base of Rocky Mountains, Twenty-five Miles from Colorado Springs.

growing season. The fact is that evaporation is under way before the crop is planted and frequently reaches its maximum after harvest and at which latter time little attention is given to moisture conservation. Vigilance and thorough cultivation are the watchwords in controlling moisture evaporation. The first principle, of course, is that of causing the moisture to penetrate the soil to as great depth as possible. The next is that of so cultivating the surface as to prevent its passing off.

Extent to Which Water Can be Stored. The possibilities for storing precipitation are shown by these figures: The Montana Station has established the water-holding capacity of soils under field conditions as about

2.5 inches per foot, and that thereby it is possible to store 25 inches of water in 10 feet of soil. At the Utah Station it was found that 95.5 per cent of the winter's rain and snow was stored in the first eight feet of soil at the beginning of the growing season. Burr has demonstrated for Western Nebraska that over 50 per cent of the rainfall of spring and summer can be stored in the soil to the depth of six feet. In this latter instance it is certain that some of the season's rainfall was stored at a greater depth and so more than half of the precipitation must have been taken up by the soil during the period when evaporation is greatest. It would seem from the above that 50 to 95 per cent of the precipitation could be stored, provided, of course, the soil is possessed of such water-holding capacity as prevails generally in arid and semi-arid soils. It is believed that the farmers of the sorghum belt can store at least near double the precipitation they generally are now storing. It is a fact, however, that unless there is precipitation it cannot be stored. But it is well established that precipitation, like feed, can be carried over from year to year. The storage of water in the soil is a continuous operation and the results are cumulative. Filling the soil with moisture in years of plenty and conserving it for the year of short rainfall should be a year after year practice.

Rainfall and Crop Production. The crop-producing power of rainfall is interesting, and a study of which will reveal the extent to which rainfall is used or in fact wasted. It requires 45 tons of water to produce a bushel of wheat and the straw thereof. But comparing this requirement with rainfall measured in inches, it is not so great. Water one inch deep over an acre of land weighs 113 tons. If this inch of water could be wholly used by the plant it would produce 2.5 bushels of wheat. In a year of 20 inches of rainfall, then, there is water sufficient to produce 50 bushels of wheat per acre, provided, of course, it could all be used by the wheat plant. To use all the rainfall is impossible. But, if one-half of

Field of Kafir Near Caldwell, Kansas, Showing Lack of Uniformity in Size of Heads and Height of Stalks.

the rainfall can be stored—and it seems this can be done in good farm practice—and of that stored at least one-half can be used by the wheat plant, then that portion of Kansas having a 20-inch rainfall should produce an average of 12.5 bushels of wheat per acre instead of less than six bushels. It is apparent that the yield could be further increased as cultural methods become more effective. There is no disputing the fact that throughout the sorghum belt the waste of moisture is unnecessarily great, and for a section so dependent upon the maximum use of the precipitation, the prevailing cultural methods seem recklessly extravagant. It is certain that the farmer's ability to store water and control evaporation marks the difference between success and failure.

Comparative Water Requirements of Crops. The relative water requirements of various crops were investigated by the Federal Department of Agriculture at Akron, Colorado, Amarillo and Dalhart, Texas, during 1910 and 1911. The average pounds of water required to produce a pound of dry matter in the whole plant were: Millet, 275; sorghum, 306; pig weed, 275; tumble weed, 277; Russian thistle, 336; corn, 369; sugar beets, 377; rape, 441; potatoes, 448; wheat, 507; barley, 539; buckwheat, 578; oats, 614; sweet clover, 709; field peas, 800; alfalfa, 1,068.

These figures reveal the difference in the use that the several crops and weeds make of moisture. The figures do not, however, take into consideration the ability of the different crops to secure moisture through their larger or smaller root systems or to escape the disastrous effects of a few days of hot winds. For instance, it is known that sweet clover will grow hay under a rainfall wholly deficient for corn, yet it uses almost two times as much water. The difference between the two plants is in their ability to acquire soil moisture. It is worthy of attention, too, that a crop of pig weeds growing in wheat stubble removes as much water per pound of dry matter as a crop of millet. Also, that sorghum requires

less water per pound of dry matter than the Russian thistle. These data help explain why corn, millet and sorghums have done better than some other crops in the regions of lighter rainfall. It is worthy of note that the legumes named above—field peas, sweet clover and alfalfa—require more water per pound of dry matter than the other plants, but it must be kept in mind that these are high in protein content and their feeding value for the sorghum belt farmer is correspondingly increased.

Recommended Cultural Practices. The foregoing would indicate that in the sorghum belt much depends upon the utilization of precipitation to the fullest possible extent and that by following well defined cultural methods the cropping possibilities are greatly increased. Also, that such cultural methods are those long since recognized as typifying the best farm practice in regions of rainfall greatly exceeding that of the sorghum belt. It is therefore recommended that the sorghum belt farmer's attention be directed as follows: He should plow deep to create a large reservoir and to encourage absorption of moisture. He should practice such cultivation as will to the greatest extent possible prevent evaporation. He should keep down the weeds, which upon many farms draw upon the moisture to as great extent as do the season's crops. He should plow into the soil all the manure and vegetable matter he can, that the water-holding capacity of the soil may be increased. He should follow a crop rotation. He should grow those crops which obtain and utilize moisture to the best advantage. And, above all things, he should govern his rate of planting by the moisture supply. It must be remembered, too, that there are controlling factors, aside from moisture, in crop production, but which will be discussed in connection with the growth of specific crops.

DEVELOPMENT OF SORGHUM BELT

The future development of the sorghum belt has been variously forecasted. There are those who see hope for greater prosperity only through return to the big pastures of the stockman. Students of sorghum belt conditions whose business it is—through state, federal and other agencies—to determine the best chances for the settler's success, believe that it will become a region of permanent and reasonably prosperous farm homes, but they hold varying opinions as to how this will be accomplished. Others predict that the time will come when a large part of the sorghum belt area will be irrigated from wells or stored flood waters. The fact is, however, that irrigation will serve in developing the sorghum belt to such a limited extent that its possibilities are not here discussed. To me, the best evidence of what the future may hold for the sorghum belt farmer, is afforded by the settler who has been able to work out a plan by which he has become established. There are numerous such settlers who have demonstrated the future possibilities more surely than they have been pointed out through other sources. The methods of these settlers should be followed by all other settlers, for such leadership is safe. Their methods are subject to improvement and development, to be sure, but these have established the precedent, which, if followed, will make the sorghum belt what every settler hopes it will be—and which hope is such as only confident and strong hearts can hold.

Opportunity in Sorghum Belt. There is little hope that the sorghum belt farmer, who is possessed of a feeling of discontent in his present location, could do

better elsewhere. Success in any other new country can be bought at no less cost for experience. Cheap lands are in demand by the ever-increasing number of farm home-builders, and the vast domain of which the sorghum belt is a part, affords as good opportunity as elsewhere for building a homestead wrought out of the soil with a small initial capital. The failure following the efforts of any early settler, is due, principally, to a misunderstanding of the country—to his inability to use it for the purpose to which it is adapted. Nor is the settler wholly to blame for his failure. A large portion of the sorghum belt was colonized under the mis-representation that it would successfully grow market crops—wheat and corn,—that all else could be lost sight of and in a few years the grain farmer would become rich. Hundreds of settlers bought homes in Central Kansas in the early day under this misrepresentation. There came a time when they were confronted with the same problems which now confront the settler farther west. The western settler will overcome his difficulties in the same way as did the settler farther east—through growing more feed and more live stock.

I think there is nothing to be gained by leaving the sorghum belt. It is doubtful if the settler can make a beginning elsewhere with better chances for success. It is my recommendation that he take new courage, a tighter grip on what he has, with a determination to attempt success by other suggested methods. I feel that the sorghum belt farmer—like most farmers in other sections—must get out of the rut in which he has fallen. Successful farming will not follow the methods of fifty years ago. Progress is the necessity of the time, in every line, and farming is not excepted. It is certain that the sorghum belt must afford homes for thousands of farmers—whether prosperous or not—and the time has arrived when those now occupying it may begin anew with a feeling of greater surety than heretofore.

Experience Best Teacher. Many good and useful things have been learned in the past thirty years for the benefit of the sorghum belt farmer. The greater part has come out of his own experience. The early day settler was encouraged in the belief that rainfall would follow the plow. The records of many years have forever banished this cherished hope. There will be periods of comparatively light and heavy rainfall as in the past, but the annual precipitation will not increase permanently. This, experience has taught at a great cost. The same teacher has shown the folly of gambling with wheat, corn, cotton, or any other single market crop in which sole dependence is placed. Farming is unsuccessful when conducted on a speculative basis, and particularly so when the winning depends upon taking a long chance on a favorable crop season. Experience has extorted a long purchase price, with usury on the deferred payments, for what it has taught in the matter of exclusive crop farming. If experience had taught nothing but the cause of failure, the teaching should be regarded as worth the cost. But, while manifesting failure along certain lines, experience has taught success along other lines—the success of the settler who has been able to forestall adversity and whose precedent is worthy of imitation.

Sorghum Crops Establish Farmers. I have asked several thousand sorghum belt farmers which crops, in their experience, have proven the most certain of production. In every instance they have named some member of the sorghum family—kafir, milo, or some of the sweet sorghums. When asked if they could make a living and some besides as a result of sorghum crops and live stock to consume those crops, they have answered affirmatively. This is the answer borne out of their own experience, or the experience of some neighbor. In patches planted here and there—sometimes well farmed but more frequently neglected—the sorghums have in every sorghum belt locality produced grain and forage year after year. Under difficulties they have proven their suprem-

Field of Kansas Orange Cane at Manhattan. Kansas, Experiment Station, 1911. Yield, 6.98 Tons Fodder per Acre Seeded with Grain Drill at Rate of One Bushel per Acre.

acy. With useful animals to consume them, they have established the occasional settler in a permanent and reasonably prosperous homestead. Through their utility, which has been proven by the settler, the sorghums promise the hope for success in the sorghum belt.

Hold Fast to Sorghum-Eating Animals. I am convinced that farmers in the sorghum belt recognize the combination of sorghums and live stock as essential to their success. But, how to make the change—how to get the start in live stock—is the outstanding and important question. The reader who is familiar with the condition of the settler cannot help realizing the importance and seriousness of this condition. I see no means by which he can be helped other than through his own efforts. The first step in that direction is to forever swear allegiance to sorghum crops and to hold fast to every sorghum-consuming animal until the herd is established. The grains of sorghums will sell for cash, and with the roughage left on the farm, the settler is in a position to help himself toward establishing the live stock herd. The sorghum belt banker will help the worthy settler in building up the live stock industry so far as his deposits will permit. In several localities there has been some organized effort of commercial interests to such end. But, the farmer will find that for a considerable time in the future, as in the past, he must help himself. The time has not yet come in this country when the same system of financial aid is at the farmer's disposal as in Germany, Denmark and other countries, and of which we are at this time hearing so much.

Keep Pace With Best Thought of Times. There are agencies giving the sorghum belt farmer, and others as well, valuable assistance in every way except financially —the honest and capable purposes of which agencies are beyond question. To these the farmer should give heed. He has heretofore looked upon them with suspicion. It has been amply demonstrated that the thought of the time, as exemplified by the experiment stations, the agri-

cultural colleges and the worth while editors of agricultural papers, has been in advance of that of the farmer. For example, the necessity of the sorghums as dependable feed crops has been preached since 1886 by the Kansas Agricultural College and by such agricultural papers as the Kansas Farmer. Little heed was given such teaching until the necessity of a few successive dry years compelled attention. When more favorable seasons came the sorghums were almost forgotten. Then came the unexpected dry year again, to find the farmer unprepared because he had planted no sorghums. Thus, the sorghum belt farmer, through his own lack of forethought, has been kept fighting for grain and forage. He has not kept himself forearmed—he was never prepared for the emergency. In 1911 the sorghums came near affording Kansas her principal roughage—likewise in 1913. In the spring of 1913 in the western third of Kansas was planted thousands of acres of corn of varieties which could only in an extraordinarily favorable season produce a crop. Only here and there was a milo field—but it produced grain. The grain sorghums matured in every Kansas county in that season. The same demonstration has been made season after season in the past. Unless sorghum belt farmers will learn some of these things "for keeps," there is little hope for a changed future condition. Those agencies which have in the past observed, have kept the sorghum belt farmer informed and the seasons and the years have proven the wisdom of their recommendations.

For twenty years the silo has been urged upon the Kansas farmer. An occasional farmer bought or constructed a silo. But not until 1911 did the sorghum belt actually begin building silos—then, in order to save all of a comparatively small sorghum acreage with its greatest feeding value. In 1913 silos were again constructed in large numbers to save in the best possible condition, a short feed crop. A dozen or more parallel examples of the sorghum belt farmer failing to give heed to essen-

tial things, could be given. Reference is made to these only to show that there is much practical thought of which the farmer can well afford to take notice. I hope that I may see the day when his mind will be more receptive—when he will sift from the great mass of matter written for him, the essentials which he can appropriate to his use with benefit and profit. Had the sorghum belt farmer accepted the doctrine of the sorghums, the cow and the silo, as has been taught for years, he would today be richer in contentment and in pocketbook.

The sorghum belt farmer should not be too severely criticised—if criticised at all. He should be dealt with in a kindly spirit. He is a pioneer in a new—and to a great extent untried—country. The pioneer's labor usually bears fruit after he is gone. However, there is no day like the present. I prefer to see the laborer receive his reward, rather than have it bestowed upon those who follow. I know there is a way by which the sorghum belt farmer of today can enjoy his reward if he will.

Sorghum Belt Lands Will Pay. What is here suggested regarding profitable and permanent sorghum belt farming is comparative only. It cannot be expected that sorghum belt lands will become so valuable or can be farmed at as great an acre profit as lands of more favorable climate under 40 to 45 inches of rainfall. It is not my belief that the sorghum belt can become a section of generally profitable farming in the same way or to the same extent that general farming exists in the heart of the corn belt. That every sorghum belt half section will be worth $100 or more per acre under general farming methods is not likely—unless it be irrigated. The uplands of the sorghum belt will never be worth fabulous prices. That they can be made to pay as high rate of interest on the investment as corn belt farms pay, is certain. That they will actually pay sufficient to warrant a higher price than they have heretofore commanded, is certain. The sorghum belt farm, under good farm management, will make its owner reasonably pros-

Kafir Sown for Forage at Manhattan, Kansas, Experiment Station, 1911. Yield, 4.1 Tons Fodder per Acre. Seeded with Grain Drill at Rate of One Bushel per Acre.

perous—it should build for him a good home with such conveniences and comforts as farmers anywhere have—it should provide him with plenty for his declining years and in the meantime should educate and rear his children to become useful, honorable and prosperous citizens.

Let Sentiment Give Way to Business. That the grain sorghums are most certain producers of grain and forage is evidenced on every hand. Every sorghum belt farmer has seen good crops of these grains mature when all other crops have failed. In 1913 grain sorghum crops matured in every county in Kansas and Oklahoma in which they were planted—not on every farm, to be sure, but for the failure there was a reason not to be attributed to the crop. The varieties of grain sorghums are numerous. There is no ground for contention as to which is the best. Each has its particular adaptability, and there is one or more for every section. The grain sorghums meet the need of every farmer from the standpoint of grain and forage for his live stock. They also supply meal for his family. The surplus sells readily on the markets. The markets for grain sorghums are mentioned later in this volume. Their usefulness is fully as varied as is that of corn. There has been a prejudice existing against the grain sorghums and which prejudice has been fostered by a general unfamiliarity in the growing of the crop, in its harvesting and in its feeding. Elsewhere in this volume are reported established practices which controvert this prejudice. It is true that there is no music so sweet as the thump of the corn ear at husking time, but when the corn crop fails, sentiment should turn in favor of the crop which withstands the season's adversity. The farmer, everywhere, needs the most certain crop, and can afford to bury sentiment for crop assurance.

Stock Farming Most Profitable. Live stock farming, in all countries and in all times, has been found the most profitable. The highest-priced agricultural land is devoted to some form of animal husbandry. Usually it has been the high price of land, together with the necessity

for recuperating the lost fertility, that has forced live stock upon the farmer. However, these are not the conditions which compel the sorghum belt farmer to a recognition of live stock. The census has shown that live stock farming in the corn belt pays from 18 to 48 per cent more income per acre than does grain farming. The average acre income from grain farming in Illinois is $10.60, from live stock farming $12.54; Missouri grain farming $7.69, live stock $9.50; Iowa grain farming $8.88, live stock $13.17. For the United States, grain yields $7.72 per acre, while live stock gives an income of $11.99, which is 55 per cent in favor of live stock. Incidentally those states which engage in dairying to the greatest extent have the largest acre income. In Kansas, the income from live stock is 36 per cent of the state's total income, wheat being 21 per cent and corn 25 per cent—each for the past 20-year period. Thus, it will be seen that live stock in Kansas—in spite of the fact that hundreds of farms sell no live stock or live stock products—is already a considerable factor. It is apparent that when the growing of live stock becomes a practice as general in Kansas as is the growing of grains for market, the farmer's income will be greatly increased. Live stock gives to the corn belt farmer the highest market for his grain and for this reason a greater acre income from the grains grown. Also, live stock farms produce the most grain. For the sorghum belt farmer live stock will not only pay the highest price for grains fed, but, a large proportion of his crop being forage which has no market value, the animal will convert that forage into cash—and that is the principle which compels consideration of live stock farming.

All Year Work Needed. One of the disadvantages of sorghum belt farming in the past—and for that matter, of grain farming everywhere—has been that a considerable portion of the farmer's time could not be converted into money. After harvest he has not been able to realize cash for his work of the late fall, winter and

early spring months. In the past he has, through intent or by chance, been idle at least one-half of the year. His experience should teach him that he cannot succeed when he works only one-half the time. The farmer is entitled to all the holidays and rest he can get, but he can no better afford to work half the time than can the mechanic. Time is what the farmer has to sell. If he sells only half of that time his possible income is cut in two. During the winter he can do little or nothing to help along the growing crops. With live stock—cattle, colts and pigs—to feed, cows to milk, or hens to look after, he can sell his time for cash. Year-around employment at profitable work is the need of every man, including the farmer. For this reason, if for no other, live stock is needed on every farm.

Stock Farm to Carrying Capacity. When I speak of live stock, I do not have reference to any particular kind, but refer to cattle, horses, mules, hogs, sheep and poultry. On the sorghum belt farm there is a need for more than one kind of live stock. A half dozen or more profitable combinations of the several kinds of live stock can be arranged. It goes without saying that every farm should keep upon it all the poultry it can accommodate. It should be the purpose of the settler to carry as much live stock of all kinds as his feed supply and pasture acreage will permit. When this maximum has been reached, then the carrying capacity of the farm can be still further increased by the use of the silo for both winter and summer feeding. Farmers have come to regard summer feeding as wholly dependent upon pasture. This is a mistake. In the sorghum belt, soiling or feeding from the silo is wholly practical and economical. The sorghum belt is admirably adapted to live stock because of its temperate winter climate and health-promoting atmosphere. In considering the kind and character of live stock, the sorghum belt farmer should make sure that throughout the year he will have at least ten cows in milk.

Eventually Fatten Cattle and Hogs. I am confident

that the basis of the agricultural development of the sorghum belt will be live stock. The only question in my mind is whether or not the quarter or half section farmer will so develop it. I am reasonably sure he can and that the present settler is justified in making the attempt. The cattleman—the ranchman—can and is doing it. I am sure that the grain sorghum belt will, through either the small or larger farmer—possibly both—become an important live stock producing section. I am not sure that the small sorghum belt farm will fatten its cattle and hogs. I believe it will. Maybe the small farmer will sell his surplus as stockers or feeders to the larger farmer or stockman who will finish them. I am expectant, though, that the development will be parallel with that in the corn belt—the small farmer selling his stock to the feeder and finisher until he becomes sufficiently forehanded financially to do his own finishing, then, like the corn belt farmer, finishing his cattle and hogs by the carload—a car of each, possibly, each year. Elsewhere I have reported the successes of sorghum belt farmers here and there in feeding cattle and hogs and in finishing them for market.

Ample Horse Power and Adapted Machinery. In the foregoing chapter it has been said in effect that the sorghum belt farmer must observe dry-farming methods. This holds good in so far as they are adapted to his section and do not involve more labor than is justified by the profit received through increased production—taking into consideration, of course, the increased certainty of the crop under dry-farming methods as compared with the ordinary methods. The sorghum belt farmer should buy farm machinery with the idea of its adaptability to his needs. Generally throughout the sorghum belt the same kind of farm implements are in use as in the corn belt. In a general way, this is a mistake. The sorghum belt farmer must cultivate a larger acreage for a given return, than is required in the case of the corn belt farmer, and so must plow, seed, cultivate and harvest

more expeditiously and there is a class of machinery built for his special needs. He should use riding implements, too. In short, he must do a maximum amount of work with a minimum energy. Also, the sorghum belt farmer has a condition of soil which requires special handling and this governs, to a considerable extent, the character of machinery used. The proper use of machinery and the efficiency of its use, depends upon the available horse power. Too many farms are short of horse power—this is as true of the sorghum belt as of the corn belt. It is my opinion that the one-man sorghum belt farm should have not less than four good horses. These should be brood mares of the draft type and each should grow a good colt each year. With ample horse power and adapted machinery, one man can handle well, 100 acres of cultivated land—including 20 to 30 acres of fall crop—and still have the time necessary to look after his live stock. The latter should be well done, too. I have not yet seen the locality in which it did not pay to do farm choring carefully—feeding hogs, calves, milking a few cows, looking after the poultry, etc. Such choring in well balanced farm operations will pay in cash return as well as the same time spent in the field—except, possibly, in harvest time.

Feed Supply in Reserve Essential. There is in the sorghum belt, as in every other area, years of short crops —not always because of dry weather, but sometimes because of late or early frosts, hail storms, etc. The sorghum belt farmer can and should in the year of plenty provide for the short year. It is certain that his forage and his hays can be carried over from year to year and their feeding value fully maintained. He can do this just as surely as he can successfully carry over wheat in the bin. So to do, however, requires a disposition to provide against the time of need. Such disposition is an in-born quality of human-kind but to a greater or lesser extent has "run out." The speculative business of growing wheat, cotton or corn, in which the sorghum

Field of Black Dwarf Cane at Manhattan, Kansas, Experiment Station, 1909.

belt farmer has heretofore engaged, is responsible for his disposition to let the next year take care of itself. He has known that if it rains he will get a crop and has felt that in case it failed to rain he would not get a crop. Speculation has to a great extent made the sorghum belt farmer a fatalist—that is, he believes that what is to be, will be, regardless of anything he may do to control conditions. When the sorghum belt farmer has a surplusage of anything, he should save it—particularly if it be grain or forage. A trip through western Kansas during the fall of 1913 showed the extremes to which an occasional farmer had gone in caring for the surplus roughage of 1912. Such men had cows or other cattle to feed. They had hauled the roughage to the barn lot and there stacked it as carefully as they would stack bundled wheat. The ricks were covered with slough grass, straw, boards, metal stack covers, etc. Such farmers had a feed supply insured for the 1913 season. Every other farmer who had a surplus of roughage in 1912 could have done the same thing, but it was noted on the same trip that on the larger percentage of farms shocks still stood in the field and by feeding time in the early fall rains had made it of little value. Plenty of roughage was grown throughout the sorghum belt in 1912 to feed through 1913 if it had been properly saved.

Silo Essential Farm Structure. The silo, with its convenience and economy as a means of carrying a year's reserve of feed, is a thing which has recently been recognized by the sorghum belt farmer. Generally throughout the sorghum belt the pit silo can be constructed with little cash outlay and made to serve as well as the silo built above ground. The low cost at which pit silos can be built justifies their general use in such numbers as will give the sorghum belt farmer all the storage capacity he can possibly need. Two are essential on every farm—one for current feeding and the other to carry the reserve for the short year. The silo conserves the maximum feeding value of the kafir,

cane or corn plant, is economical in the use of storage space, and feed in the silo is proof against damage by wind, rain or fire. The pit silo is generally adapted to the sorghum belt—first, because it is within the reach of every farmer, and second, because the character of the soil is such as makes it successful. It cannot be cheaply built when the excavating must be done through rock. It may cave in if built in sand or gravel subsoil. Conditions adverse to the pit silo, however, do not generally exist in the sorghum belt, so it is another of those advantages of which the sorghum belt farmer can better avail himself than can his neighbor farther east. I do not regard the pit silo as a permanent structure, but the sorghum belt farmer has for years been compelled to erect more or less temporary buildings for all purposes and he should no more hesitate about building a pit silo than he would about building a straw shed or other temporary stabling for his animals. The construction and proper use of a pit silo will enable the farmer to later erect above ground any kind of silo he may choose. By the use of a silo he will be able to build a barn, too, and it will help him to other better things. The silo is urged because it is the greatest help to better feeding of all kinds of live stock, and with kafir and cane for silage, the sorghum belt farmer can have as good and as sure roughage for all kinds of live stock as can the corn belt farmer.

Need Garden as Well as Grain Sorghums. The sorghum belt farmer can well afford to give careful attention to a garden patch. A productive garden will save much cash outlay and it should be the aim of every farmer, everywhere, to grow as much as possible of the things needed for the support of his family. The farmer does not have as much money coming in as those engaged in some other lines of business, but it is not necessary for him to have as much going out—and that's where he has the advantage of the man in town. Garden crops generally do not require more soil moisture than do field

crops. The garden patch should at all times be handled with a view to storing and conserving the soil moisture. It should be plowed deep early in the fall. Into it should be worked such manure as is necessary to bring the soil to a high state of fertility and to provide such decayed vegetable matter as will increase the water-holding capacity of the soil to the maximum. Cultivation in the garden is essential, both as a conserver of moisture and that it may be kept absolutely free from weeds. If the farmer feels that he must irrigate the garden, it can be done successfully by the windmill from his stock watering well. He may use either surface or sub-surface irrigation. The latter is probably the more efficient and uses the least water. It is not my desire to suggest further than the necessity for a garden. A large part of the family's living can come therefrom and I know it is cheaper to grow peas, beans, tomatoes, etc., in the farm garden, to be canned at home, than to buy the Maryland product off the shelves of the general merchant. The farmer should kill and cure the pork and beef needed by his family. Butchering is a lost art on the great majority of western farms. The failure of the farmer to live so far as possible on his own products is costing the farming public millions of dollars annually. He can, if he will, live better and at less cost by producing a large part of what he eats.

Money Crops Needed. It is not to be inferred from anything heretofore said that the grains of the sorghums are not money or cash crops as well as feed crops. Elsewhere the markets for and prices of these grains as compared with other grains, are reported. It should here be understood, however, that the grains of the sorghums sell readily and are as good cash crops and far more dependable than any other market crops the sorghum belt farmer can grow. But, he needs a diversity of crops; first, that labor may be distributed so far as possible throughout the year; second, because of the rotation needed for keeping his fields in the best physical

condition; and, third, that the seasonable risk may be as widely distributed as possible. It does not pay to place all the eggs in one basket. Diversification of money crops is the part of wisdom.

Wheat on Sane Basis Essential. It has been said that wheat farming should be eliminated from the farm practice west of the 98th meridian. I am not in accord with such statement. The sorghum belt farmer needs wheat as a cash crop. He needs it for reasons too numerous to mention. The principal reasons are that he needs the money, it can be grown without interfering with feed crops, and that the necessary rotation may be employed. Besides, wheat is a dry-farming crop. The hard winter wheats have a place in the successful farm operations of those parts of the sorghum belt in which they are now grown. The trouble in the past with sorghum belt wheat growing by the small farmer, has been that he has engaged in it on too large a scale and has depended almost wholly upon it. I have known a number of the so-called wheat kings and each has died poor. Nevertheless, there has been much money made from wheat by sorghum belt farmers as well as farmers elsewhere, and much more will be made as a result of good agricultural methods and conservative acreages.

The farmer in those sections of the sorghum belt now growing wheat, needs it in a comparatively small way —at any rate not in a larger way than will permit of the thorough and early preparation of the seed bed and seasonable seeding. The acreage should be limited to that which the farmer and his family can seed in season and harvest with the smallest possible cash outlay for hired help. The possibility of securing the needed help in harvest is more uncertain than the seasons, and I would have the small general farmer measure his operations by his available family help. The hired man has caused the failure of many a farmer, and while thousands can so manage their affairs as to make him a profitable investment, the larger percentage cannot.

In the future as in the past, wheat will continue to be an important crop of a large part of the sorghum belt because it is the best money crop in those sections in which it is grown. Its uncertainty of the past can to a great extent be overcome. Actual farm operations have proven that this can be accomplished. The adoption of a rotation, with summer or early fall plowed land, a thoroughly prepared seed bed, and seasonable seeding, has produced three or four times the average acre yield under former methods. Within the limitations prescribed I am sure wheat will assist materially in the upbuilding of the sorghum belt. It is a cereal for which there is an ever-increasing demand. A filled wheat bin is near money in the bank. Wheat as a cash crop is so necessary to the plains settler in the wheat growing sections, that he must master those cultural methods which promise the growing of a small acreage at a near assured annual profit.

Cash Crop For Nearly Every Condition. Other money crops, to accompany wheat or to be used in sections not adapted to wheat, are cotton, broomcorn, rye, barley and oats. These are staple crops readily marketable. Like wheat, their residue or by-products are of value in stock farming. The seed of cotton is needed for supplying the protein necessary to balance the ration made of the grain and the roughage of sorghums. The seed of broomcorn has feeding value equal to the seed of the sweet sorghums. Rye and barley each afford pasturage and straw and so contribute largely to the economical and satisfactory support of live stock. Their grains have high feeding value for all kinds of farm stock and when needed for feed can be marketed through stock as advantageously as any crop the farmer can grow, yet as a money crop they sell as readily as wheat. The oat crop is seriously neglected in the sorghum belt. There are several varieties which are quick growers, using the early spring rains advantageously and so are likely to escape later dry weather. The grain of oats

Field of Black-Hulled Kafir Yielding 30 Bushels per Acre in 1911—a Poor Corn Year for Kansas—on Poor Corn Land. This Field on Manhattan, Kansas, Experiment Station Farm.

is recognized by every farmer as a valuable feed. The hay of oats is not fully appreciated either as a feed of superior quality or as a "sure feed crop." There are few seasons when oat hay cannot be grown in profitable acre tonnage. The hay of oats is more valuable as feed than the hay of millet, rye or wheat.

I cannot dismiss this topic without mention of spelt and emmer. These are little known in the sorghum belt. They came from a section of Russia having hot, dry summers. Their performance in the Dakotas has been such as to commend them to our arid and semi-arid sections farther south. As feeds they are near the equal of barley, but are not grains of commerce to the same extent and are here mentioned more particularly as feed crops which will add variety and palatability to the sorghum belt ration and which will work into the needed field rotation.

Balanced Farming Will Pay Best. It is our opinion that the sorghum belt farmer can, and should in a measure, be a crop-producing farmer, but his operations must be so arranged that he is not dependent upon the cash market crops produced. His every effort should be for the production of feed for all the live stock he can keep. However, by consistent good farming methods, which are exemplified in the dry-farming practices, he can grow cash market crops with a reasonable degree of profit and the cash income received therefrom will prevent the necessity of selling cows or calves at a sacrifice. When such crops fail to produce market grains, they do produce feed and which feed in the form of straw or pasture is frequently worth as much money as the grain crop.

Dairying as Farm Industry. I am sure that most sorghum belt farmers realize the advantages of and the necessity for keeping cattle. How to get the start is important. In the case of many farmers that start must be made with two or three cows—maybe only one. Make some sort of turn to get the cow or cows. That

Field of Kafir Yielding 2.87 Tons Fodder per Acre in 1911. Drilled in Rows at Rate of One-Quarter Bushel per Acre. On Farm of Manhattan, Kansas, Experiment Station.

farmer who has a cow should not sell her until his herd is established. If the cows are few they should by all means be milkers and should be milked. The fact is that three or four cows—if they are the only stock of the farm—are worth almost their weight in gold, to the settler. The common cow of the plains farmer will serve as the nucleus of the milking herd or stock cattle herd. The advantages of the milk cow to the farmer who is not firmly established financially, are not disputed. There are many who believe that the farmer of the sorghum belt cannot establish permanent farming operations without having a milking herd and that the number of cows be limited only by the help he has for milking. Should the farmer be absolutely dependent upon himself as a milker, I do not excuse him from milking eight or ten cows each night and morning. I did as much for years and know that the time expended was more profitable than that expended in any other work.

I have numerous records of far western Kansas and Oklahoma and eastern Colorado farmers who are realizing $35 to $45 per cow per year from a herd of ten cows, this income being from the sale of butter fat alone. The value of the calf, the value of the skim milk for feeding calves, pigs and chickens, will come near equaling the income named. Such amount of money has come from the milking of the so-called common cows, fed on sorghum roughage and grains and the pasture of the plains, and given such care as the ingenuity of the careful and painstaking owner makes possible.

Western Kansas Cow Income. C. W. Jones of Thomas County, Kansas, milks cows in the "fat" years as well as in the "lean" years. In 1912 he milked 14 cows and here is his report: Cream sold, $555.76; twelve calves raised worth $25 each, $300; cream and butter eaten at home, $60; 1,500 pounds of hogs fattened from milk and slop, $105; total, $1,020.76, or an average income for the year of $72.91 per cow. You can't

Field of Pure-Bred, Black-Hulled Kafir, 1909, on Manhattan, Kansas, Experiment Station Farm. Note Uniform Size of Head and Height.

tell Mr. Jones that it does not pay to milk cows, for he has the figures to prove that it does. The important thing, however, is that every sorghum belt farmer who will get a bunch of cows can do as well.

Henry P. Von Ann of Sheridan County, Kansas, milked ten cows during 1912 and here is his statement: Cream sold, $609.91; nine calves raised, worth $25 each, $225; home use of milk and cream, $50; total, $884.91, or an average per cow, of $88.49.

Oklahoma Cow-Milking Results. During the year 1911 the dairy department of the Oklahoma Agricultural College investigated the income from the milking herds on 100 farms widely distributed throughout the state. The average return per cow per year for 33 herds, on which complete returns were obtained, ranged from $18.75 to $54.55 per cow. This gives a good idea of the income from the farmer's cow in Oklahoma. Incidentally it shows the difference in cows, too, pointing to the fact that it is worth while to have good cows. But, the essential thing is to get the milking habit by milking the kind of cow it is possible to obtain. Selection and breeding up for improvement can and will come later.

Colorado Cow-Milking Results. H. B. Rice of Calhan, Colorado, in the fall of 1912, dug a pit silo and filled it with kafir. His herd of six cows yielded butter fat which brought checks averaging $65 per month from October to May, inclusive.

J. W. Classen, in eastern El Paso County, Colorado, during the summer of 1913 was realizing $10 per week from seven cows through the sale of butter fat, and J. J. Wassam, Yoder, Colorado, milked four cows which produced $30 worth of cream per month. These latter two are summer milking records, but each man has a pit silo and by having cows fresh in the fall, the silage enables them to realize as much money in winter as in summer.

Hundreds of other similar reports could be given to

show what sorghum belt farmers are realizing through the milking of common cows, fed and cared for in a very ordinary, farmer's way. Reports on grade cows of dairy breeds show nearly double the butter fat sales above given. But, I have preferred to show what the settler can expect from the best of such cows as he may now have, rather than report results from specialized dairying.

Man Who Milks Cows Not in Debt. The thoughts of a Thomas County, Kansas, banker are significant, in the light of what has been stated regarding cow milking. It was in 1901 that I made my first visit to his county. A few years later I had occasion to compile figures on the total sales of butter fat at the cream receiving stations of that county. Thomas County was then selling about $50,000 worth of dairy products per year, and five years later when another investigation for the same purpose, was made, the sales totaled less than $20,000. I wrote I. W. Crumley, asking why farmers were not patronizing the milk cow as they once did. Here is a part of his reply:

"I remember you well in the old skimming station days when The Continental Creamery Company made a campaign of education in the milking of cows. This country commenced to get to the front at that time, and everybody milked some cows then and had money to pay their bills. When the butter and eggs do not pay the running expenses of the western farm, the farm is not being run on right lines, and any farmer who will not keep track of what his cows bring for him does not know what they have done.

"This country will support a large number of people if they will stick to cows and poultry. But we had a number of good crop years and the farmer fell over himself to put a whole township to wheat, drilling it in the stubble year after year, and of course we know the results—he does, too, now, but it has proven expensive knowledge. In the rush attendant upon growing so

much wheat he didn't have time to milk the cows and so sold them. This was the greatest mistake he ever made.

"Any banker can look over his territory and tell you the man who stuck to his cows; he is the man who does not owe anybody. I am encouraging my customers to buy cows, and any good man wanting money with which to buy cows can get it from me.

"You are on the right track. I am glad to see you take an interest in Western Kansas, for as a rule the papers are inclined to take a whack at Western Kansas whenever the opportunity presents, instead of giving us the encouragement we need."

Cow is "Never-Failing Cash Producer." The development of the sorghum belt is largely dependent upon the milk cow, according to H. M. Cottrell, a former Kansas farmer and educator and close observer of western conditions. He is now Agricultural Commissioner of the Rock Island Lines, and his recommendations are being followed by the Immigration Department in suggesting to settlers the most likely road to success. Here is what he says of Eastern Colorado, but which is applicable to the entire sorghum belt:

"The average 320 acres in the dry farming districts of Eastern Colorado farmed right will return a cash income of $1,500 a year besides all the farm products a large family can use. The dairy cow is the one never-failing cash producer of the plains, and a well-selected one will return $75 and upward a year when fed silage and dry forage, made from dry land crops that never fail. The skim milk fed with milo or kafir makes hog-raising profitable. A well-selected, well-cared for hen will return $2 a year on dry land feeds and the dry land farmer, who will, can keep 200 to 400 laying hens. Wheat is a good cash crop in wet years and Mexican beans in dry years. A windmill will irrigate an acre or more that will furnish more vegetables and fruit than

a large family can use and the water will make flowers, trees and a lawn grow.

"The cow is the foundation of money-making on the dry land farm. Where there are cows there is a prosperous home. A cow of strong dairy type, either grade or pure-bred, fed a properly balanced ration of home-grown dry land feeds will return $75 a year from the sale of the butter fat in her cream. Creameries in the Southwest pay the farmers cash on delivery for each shipment of cream, so that a good dairy herd returns a cash income two or three times a week the year round and year after year whether the season be wet or dry.

"The skim milk can be fed to calves which can be fattened on milo and silage and marketed at a high price as 'baby beef' when fourteen months old, or the skim milk can be fed to hogs with milo or kafir and the best of pork produced. A part of the skim milk can be fed at a good profit to laying hens.

"The man who goes on to a dry land farm should take at least ten good dairy cows with him; if he understands dairying he should take twenty. Don't think of dry land farming without thinking of dairy cows. Don't plan to go on a dry land farm without planning to take a herd of dairy cows with you. Don't attempt to make a living on a dry land farm except from a herd of good dairy cows. Every other way is too uncertain.

"There is plenty of wind in a dry farming country and a windmill will pump the water needed for the house and stock and a surplus sufficient to irrigate from one to two acres. One acre of irrigated land will furnish more vegetables than a large family can use and an ample supply of rhubarb, asparagus, gooseberries, strawberries, currants, and early cherries. The rest of the water can be used on a lawn and shade trees. The cows will furnish a good cash income and the windmill will supply the water to make a comfortable and attractive home."

Cows Will Pay Family and Farm Expenses. It is apparent that the farmer can have a cash income of $500

to $600 per year from a herd of ten to fifteen common cows through the sale of butter fat alone. The cash received each time the cream is marketed is sufficient to supply the farm with the money necessary to prevent the accumulation of debt while waiting for crops or for the growing young stock to reach the highest value. It is to avoid the accumulated store and other bills, for which the settler should strive. Along with the cows and calves there should be pigs and a few colts, the sale of which, together with that of wheat or other cash crop, will result in a lump sum to be applied on the mortgage or toward the building of a barn or dwelling or maybe purchase of more land. It should at all times be kept in mind that the farm should be made to produce a great variety of commodities—live stock, live stock products and field crops—which are of easy sale. The more varied the products of the farm the smaller is the chance for failure. Obviate the necessity for accumulated store bills and other debts, by milking cows and selling eggs, and the income from other sources may then be so applied as to result in adding to the actual wealth of the settler.

Live Stock Developed Central Kansas. For thirty years I farmed in central Kansas, and, as I have said, the conditions in that section in the early day of its development were not materially different from those existing throughout the sorghum belt. Permanent and profitable farming there came through the same general plan as that suggested for the plains farmer. During the past ten years I have talked, eaten and slept with the western farmer and feel that I know his condition and situation as well as can anyone except the man who has actually spent years in farming the plains. So I feel that the sorghum belt farmer's hope lies along the lines suggested. Speculation has not brought to him permanency or prosperity in the past. There is little hope that it will in the future. The sooner he settles down to a moderate wheat acreage or other cash crop,

the sooner he patronizes live stock as a means of consuming those surer producing grains and forages, the sooner will he become a permanent fixture in the territory in which he now lives. Farming is not a "get-rich-quick" business. It is a question of good management, one of frugality, one of mastering the soil and climatic conditions, and so becomes a life-long business. The farmer who has earned a good living and some besides, and who leaves to his family a well improved farm, free from debt, has accomplished as much as most farmers hope to accomplish, and has done much more than the large percentage of those who seek their living through other means.

Boiled Down Sorghum Belt Suggestions. As a result of the experience of many sorghum belt farmers who have succeeded far beyond the average, these conclusions seem worthy of consideration:

(1) That grain sorghum crops are the most certain of production and should have precedence over other cash market crops.

(2) That in these surest of feed crops with live stock to consume them, lies the best hope for the sorghum belt farmer.

(3) That the generally accepted dry-farming methods must to a certain degree be employed in the growing of grain sorghums and such cash crops as are regarded best adapted to the various sections.

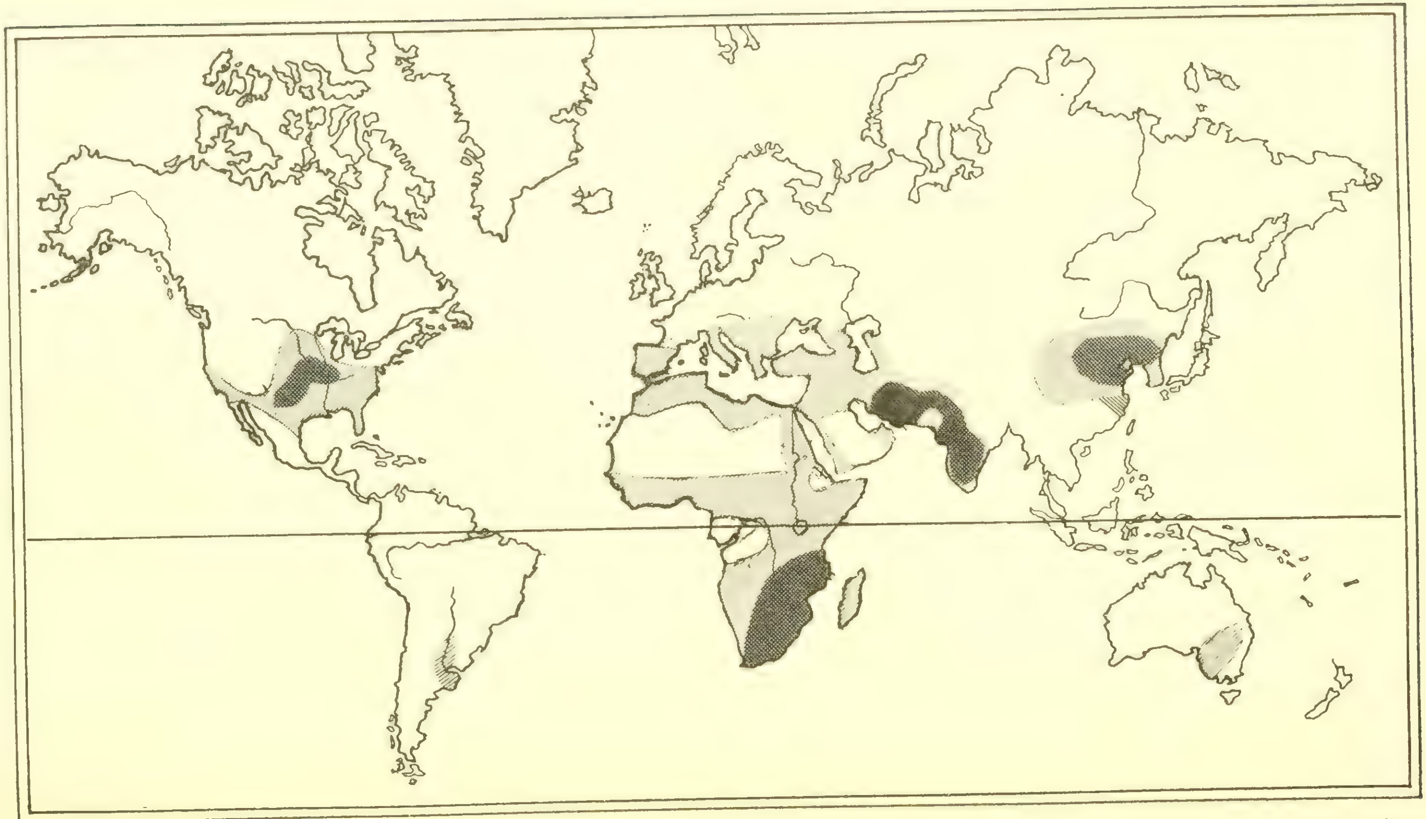
(4) That at least one year's reserve feed supply should at all times be carried.

Let these conclusions be the guide of the sorghum belt farmer. By following them, with good judgment, and by keeping everlastingly at it, he stands to win, and if he loses he will not be worse hurt than he will by continuing to follow his present methods.

GRAIN SORGHUMS IN GENERAL

The Old World history of the grain sorghums is not essential except as it may add to the reader's interest and throw some light on their adaptability to and usefulness in the sorghum belt. The outstanding facts regarding their growth and use in other countries may tend to a wider appreciation in those sections of this country in which necessity compels their consideration. The grains of the sorghum family are the staple cereal crops of 700 million people of India, Egypt, China, Africa and other countries, and so generally and in such quantities are they grown as to make them the third largest cereal crop in the world. By the people of the above named countries the grain is used for every purpose for which we in the United States use wheat and corn. The grain of the sorghums is their staff of life. Their live stock feed upon the grain and forage. In many parts the coarser stalks are built into shelter for both man and beast.

As would be expected, the agricultural experiment stations of Africa, East India and Egypt have taken note of grain sorghum production. These stations record large yields on the most fertile soils in the sections of heaviest rainfall. They also record their adaptability to the high altitudes, the short growing seasons, the poorer soils and the sections of light rainfall. The conditions recorded, and under which they are grown, vary from the humid to the arid, and from near sea level to an altitude of 4,500 feet, although it is said that the grain yield is light at an altitude of 3,900 feet. It is indicated by the map that the sorghums in the Eastern Hemisphere are grown as far north as latitude 45 degrees, which is the latitude of St. Paul, Minnesota. While we



Map Showing Areas Where Sorghums Are Grown. The Dark Area Indicates Sections in Which the Crops Are Grown More Extensively Than In the Ruled Areas. Map Re-Drawn from the "Sorghum Primer" Issued by Kansas Agricultural College.

have not adapted grain sorghums in a general way north of latitude 42 degrees, which is the Kansas-Nebraska line, in Montana and in the Dakotas milo, in particular, has given good yields at 45 degrees. Also through Nebraska and the Dakotas sorghums for forage are quite generally grown. Reference to the map will reveal the fact that every country on the globe having the same latitude as the sorghum belt in the United States, is growing sorghums. This indicates that the home of the sorghums, in general characteristics, presents a wider range of conditions—favorable as well as unfavorable—than does our sorghum belt. It should be understood, however, that the grain sorghums as growing in the Old World are, for the most part, unimproved and so widely varying in their usefulness as a grain or forage.

These remarks are presented as evidence that farmers in the sorghum belt are not experimenting with a family of plants originally grown under such conditions as to make their performance problematical or of doubtful value. Upon their importation to the United States the Federal Department of Agriculture has, through its various agencies, improved the original sorghums by selection and cultivation, and the sorghum belt farmer can make them still better suited to his needs by continuing these, as will be shown later in this volume.

Introduction of Grain Sorghums Into United States. For more than 150 years the people of the United States have been interested in sorghums. Of the first importations only broomcorn became permanent. In 1853 sweet sorghums were imported from China and in 1857 an importation was made from Africa. These were for sugar-making purposes. The first permanent importation of grain sorghums was brown durra and white durra. These came by way of California and in that state in 1874 were grown under the names, brown "Egyptian corn" and white "Egyptian corn." In 1880 to 1884 the white durra was grown in Kansas, Oklahoma and Texas as "rice corn," and in 1890 to 1894 it was

grown in the same states as "Jerusalem corn." These durras were of early maturity and dry weather resistance but were short-lived in their usefulness, due, it is said, to the extreme waste in handling resulting from excessive shattering when ripe. However, the brown and white durras are still sparingly grown in Texas and New Mexico and west to California.

Threshing Kafir in the Interior of Africa.—Natives Beating Seed from Heads with Straight Sticks.—Photo by F. L. Snow, Topeka.

In 1876 white and red kafir were imported from South Africa. Kafirs were first cultivated in the Southern States. Experience, however, soon proved that they were best adapted to that territory which is now described as the sorghum belt. In 1886 the kafirs were introduced into general use on a large scale in Kansas, Oklahoma and California, by the experiment stations of these states. The black-hulled was not imported as a distinct crop. Its origin is not definitely known. It is believed, however, that it was separated by selection from the first importations of red and white.

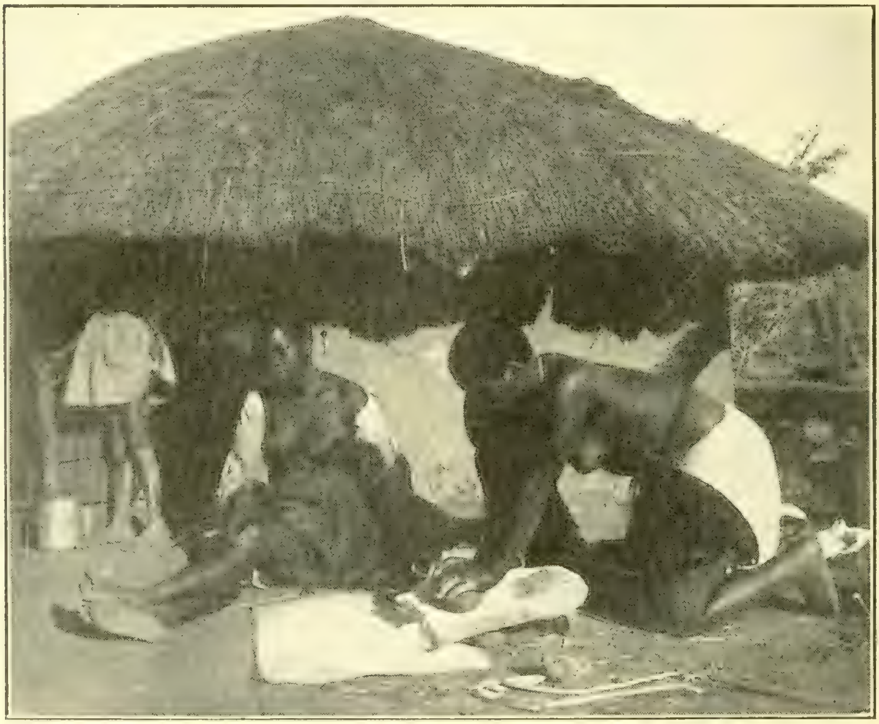
Milo was introduced into the Southern States in 1885 but did not become a staple crop until 1890 when it was planted in Western Texas, and since that date has in sections of that state been the principal grain crop. It has been acclimated and gradually moved north and is a dependable grain crop as far north as the Kansas-Nebraska line. However, it is being grown still farther north but to date in a limited way only.

It is interesting to note that kafir was introduced by the Federal Department of Agriculture at a total introductory cost not to exceed $5,000. Inasmuch as the annual value of the grain in the "semi-arid Southwest"—not including Kansas—is in excess of 20 million dollars, it is apparent that the department made a wise expenditure of public funds. The department in its 1900 Year Book, said: "There are now about 600 thousand acres planted to kafir in the State of Kansas alone, and it has been predicted that within ten years at least two million acres will be grown annually in that state." The fact that in twelve years from the time the prediction was made, Kansas was growing one and one-half million acres, proves that the guess was fairly accurate.

Divisions of Sorghum Family. The sorghums, much to the confusion of the farm-reading public, are variously classified. While I do not regard the classification of the grain sorghums as essentially important to the farmer, nevertheless it is desirable that a simple classification be made and that it be kept in mind. That the reader may know in a general way—and which is sufficiently accurate for all practical purposes—we submit these groups in the order of their importance to sorghum belt farmers: (1) Kafirs; (2) durras; (3) sweet sorghums; (4) broomcorns.

Kafirs. In the kafir group are common and well known varieties—black-hulled and red. The distinguishing characteristics of each are well indicated by the name. The black-hulled has white seed, black glumes,

and grows five to eight feet tall. The red has red seed and black glumes. A dwarf black-hulled has been developed by selection and this has white seed, black glumes, and grows three to four and one-half feet tall. In some sections is still grown the white kafir. This variety, however, has not met with the approval of farmers generally. In the writer's experience it proved of later



Grinding Kafir Meal in Interior of Africa.—Natives Crushing the Grain Between Stones.—Photo by F. L. Snow, Topeka.

maturity than the red or black-hulled but a heavier yielder. It has white seed and white glumes. The kafirs are grown for both grain and forage. Many farmers use the same planting for both purposes; others, however, are more successfully planting thin for grain and thick for forage.

Durras. The durra group includes both brown and white durra, which, keep in mind, have been grown in

this country under the names of "Jerusalem corn," "rice corn" and "Egyptian corn,"—and in fact other names which have proven attractive bait to unsuspecting seed purchasers. The group also includes Sudan durra which is a recent importation and which is commonly called "feterita." It came from Egypt in 1906. Yellow and white milo also belong to the durra group. The grain of each member of the durra family serves the same purpose for feeding as does the grain of the kafirs. However, the forage does not equal that of either kafir or the sweet sorghums because of the fewer leaves and the more woody, pithy stalk.

Sweet Sorghums. To the sweet sorghums belong all varieties of those plants which farmers commonly call "cane," and many varieties are grown in the sorghum belt. The sweet sorghums deserve better treatment in every respect than they get. The pure seed of the several varieties sells readily and a crop of cane seed is as profitable a cash crop as many sections can grow. The mixing of varieties has greatly depreciated the value and usefulness of the cane crop. The best variety for the sorghum belt is Amber. There are several strains of Amber, but the red is the earliest, usually maturing a crop of seed before frost. The Ambers do not grow as large as other varieties, making a quality of forage more conveniently handled and more readily eaten by live stock. Freed sorghum, or white cane, has recently been developed in Western Kansas by a farmer whose name it has been given. Through the Federal Department of Agriculture it has been introduced into various sections of the sorghum belt. Its forage is said to possess all the qualities of other sweet sorghums. In addition it seeds more heavily than others and the seed possesses a greater palatability and so a higher feeding value than that of other sorghums. Early Orange is grown throughout Kansas. It is of medium late maturity. Sumac is grown in Kansas and Oklahoma and is especially desirable for syrup. It should prove a superior silage

variety since it produces a large tonnage. There are many other distinct varieties and cross-hybridized varieties grown successfully for hay or silage.

The analysis of the grain of the sweet sorghums indicates that it is the equal of kafir or milo in feeding value, but from the standpoint of palatability and digestibility is not so desirable or valuable, but nevertheless is an important grain. The feeding value of the seed of sweet sorghums, as compared with that of kafir and milo, is elsewhere discussed.

Broomcorns. The broomcorns are valuable for their brush and for the seed to reproduce their kind. There are numerous varieties but as none is of special value for its grain or forage as compared with kafir, milo or the sweet sorghums, they are not here considered. It is not amiss to say, however, that the analysis of ripe seed indicates that it is only slightly inferior to corn. If the seed from a brush crop is dried and stored it will furnish feed of considerable value.

Names Used. The reader will please note that in this volume "kafir" is used instead of "kafir corn" and "milo" instead of "milo maize." The sweet sorghums are referred to as "cane" since the latter is the word now commonly used and generally well understood by farmers in speaking of those sorghums grown primarily for their forage. When the kafirs, milos, durras and sweet sorghums are spoken of collectively and when reference is made to those things common to each, the word "sorghums" is used. When reference is made to those sorghums which produce grain they are designated as "grain sorghums." Also the term "black-hulled" kafir is used instead of "black-hulled white," and "white" instead of "white-hulled white." The abbreviated terms are sufficiently descriptive of the varieties and are more simple.

Common Varieties Under New Names. The staple and well known varieties of grain sorghums are frequently sold under new names, with extravagant claims

as to dry weather resistance and productivity. Farmers, generally, know this common graft in the sale of the seed of many farm and garden crops. Reliable seed houses do not engage in this kind of business. The latest example of such questionable methods occurred during the past winter when the seed of "Schribar corn" was advertised for sale throughout Oklahoma at twenty-five cents per pound. The Federal Department of Agriculture advises that this "corn" is indistinguishable from feterita, the seed of which can be obtained at much lower prices. It is well for the purchasing farmer to make a careful investigation into the merits of so-called new grain sorghums before buying them. Obtaining a sample of the seed will usually enable him to know whether or not it is of some established and common variety. The state experiment station authorities will advise whether or not the seed merits its advertised claim. Many farmers have a somewhat foolish desire to try out so-called new dry weather resisting crops and will pay long prices for seed which promises more certain production than those proven crops they already have. It is well for the farmer to remember that the experiment stations are at all times investigating various new field crops and new varieties of established crops. It is not the part of wisdom to plant a considerable acreage of any seed until the experiment station authorities or good farmers have placed their approval upon such crop.

Habits of Sorghum Growth. Experience should have taught the sorghum belt farmer that the sorghums are more dry weather resistant and of earlier maturity and more certain of production than is corn. There would seem to be no good reason for a detailed explanation as to why these plants differ in these respects. However, a full understanding of the characteristics of the sorghum plants will enable the farmer to more fully appreciate their adaptability to sorghum belt conditions, and so justify his greater dependence in them.

Black-Hulled Kafir on Manhattan, Kansas, Experiment Station Farm.—Note Uniformity of Heads and Height of Stalks.

The sorghums have an extensive root system. This has been noted by every farmer who has plowed a field following a sorghum crop. The soil is usually so full of roots as to make plowing difficult and the ground turns up soddy and lumpy. This would indicate that sorghums have more numerous roots than has corn, but this is by no means established. The dry condition of the soil following sorghums, however, is evidence of the ability of the sorghum plants to extract moisture from the soil to a greater extent than does corn, and through which moisture the plant obtains the food necessary for its development. The sorghums have the faculty of deep rooting, if necessary, to obtain moisture. Their greater ability to adapt themselves to moisture conditions is one of the reasons why the sorghums are able to withstand dry weather and heat to a greater degree than is corn. In a dry season the sorghums will root more deeply than in a wet season. If the required moisture is near the surface the roots will be found near the surface. This is a condition which should affect the methods of cultivation and which methods are later discussed.

The grain sorghums are in every locality and from every standpoint compared with corn. The fact is that we have no variety of plants so comparable with corn in every respect. The grain sorghums grow best and produce the largest acre yield of grain and forage under those conditions most favorable to corn. However, it is well known that under conditions unfavorable to corn the sorghums are much more certain of profitable production. Through many centuries of cultivation in the tropics they have acquired an adaptability to widely varying climatic and soil conditions. The character of the plant is responsibile for its wide range of adaptability in the sorghum belt. The ability of the sorghum plants to control transpiration is one of the important differences between them and corn. The sorghums, like all other plants, are constantly absorbing water from the soil through the roots and much of this water passes

into the air through the pores of the leaves. This action is comparable to the escaping water through the human skin in the form of perspiration. The curling of the sorghum leaf during a long dry spell or during the heat of the day, thus reducing the amount of water passing from its leaves, has resulted in the common observation

Prize-Winning Kafir Heads, Butler County, Kansas, Kafir Carnival.

that the sorghums will withstand a dry spell with comparatively no injury and so "wait for rain." When the leaves of corn begin to curl as a result of dry weather or extreme heat, there is undoubted injury being done the crop. By reducing the moisture thrown off by transpiration, the sorghum plant is simply conserving the available moisture and while so doing is not growing, but is retaining life and so is ready to produce seed and forage when moisture conditions are favorable.

The early maturity of the sorghums as compared with corn, is also much in their favor. The need for grain sorghums is greatest in the dry sections which have a short growing season and in which sections the rainfall occurs largely during the early part of the growing season. This is a condition particularly true of the sorghum

belt, and, as has elsewhere been stated, rapid growing and early maturing plants are able to utilize such rainfall to the fullest possible extent, the plant developing and maturing in advance of the later and drier part of the season. The early plant requiring a shorter growing season, not only uses less water but uses that water earlier in the season, and so, as in the case of the sorghums, is able to mature seed on the early rainfall. The sorghums should be kept of early maturity and which characteristic can in fact be further developed by saving the early ripening heads for seed. The natural tendency of the sorghums is to become later in maturity. Mixing with other varieties by cross-fertilization has the further effect of delaying maturity. It is apparent, then, that if the grain sorghums be maintained at the highest degree of usefulness their seed must be given such care as will preserve those characteristics which are essential to the most certain production.

One other important feature of sorghum development is that of "dwarf stature." This has been recognized in the case of corn, too, the early maturing varieties being the dwarf varieties. The small stalk requires less water than the large stalk, and dissipates less water through transpiration. So a small stalk producing as large head or ear as the large stalk, has a decided advantage in a season or section of light rainfall. Dwarf varieties of kafirs and milos are not necessarily more dry weather resistant than the common or large varieties, but their lower water requirement is certainly desirable in seasons or in sections in which moisture is the limiting or controlling factor in crop production.

Comparative Earliness of Milos and Kafirs. The milos are earlier than the kafirs and so are adapted to the higher altitudes of the sorghum belt and to the sections of lighter rainfall. In the Panhandle of Texas and the western third of both Oklahoma and Kansas, they mature in ninety to one hundred days. They are grown in New Mexico and Colorado at altitudes ranging from

4,000 to 5,000 feet, but it must be remembered that at high altitudes the nights become quite too cool to permit rapid growth, thus delaying maturity. The milos are generally believed to be more dry weather resistant than the kafirs, although it is said by those of authority that this has not been established.

The several commonly grown varieties of kafir mature three to four weeks later than the milos. However, the Federal Department of Agriculture has developed strains of kafir which mature about two weeks earlier than the ordinary kafirs and only a few days later than milo. The white kafir quite common in Kansas twenty years ago, was the latest maturing variety, and on account of this and other objections is not now grown to any considerable extent. The red of twenty-five years ago was the earliest maturing variety of kafir, but this is no longer in general use in Kansas. It was a lighter yielder under ordinary methods of farm handling and not more than a week earlier than the black-hulled. The red kafir became later as it was planted at the higher elevations and at the Amarillo, Texas, station it has been consistently later than the black-hulled. Practically all the kafir grown throughout Kansas, Oklahoma and Texas, is the black-hulled. It has met the approval of the farming public to a greater degree than have other varieties. The dwarf black-hulled kafir is likely to ultimately succeed all other varieties in the sorghum belt. Its dwarf stature increases dry weather evasion and facilitates harvesting by machinery.

Effect of Earliness and Dwarfness on Yield. The actual money value of early maturity in sorghum crops is not fully appreciated by the sorghum belt farmer. The advantages of dwarf stature are not fully understood, either. There is no argument so forceful as that afforded by the comparative yields of early maturing sorghums as compared with later maturing, and of the dwarf stature as compared with the common strains. That special attention should be given these two charac-

teristics seems justified in the fact that it is necessary for the farmer to perpetuate each to a considerable extent by careful handling of the seed. These figures by Ball, agronomist in charge of grain sorghum investigations for the Federal Department of Agriculture, are convincing on these points:

"Milos are earlier than kafirs, but are not known to be more truly drought resistant. At Amarillo, Texas, under conditions of severe drought from the middle of July until October, 1909, the milos yielded on the average 8.3 bushels and the kafirs only 5.5 bushels to the acre. In each crop the figures are the average of between 20 and 30 plats and show that the difference was really in the earliness—and perhaps dwarfness, also—of the milos as compared with the kafirs, the yields in normal years being about equal.

"The season of 1910 was still drier, only 10 inches of rain falling at Amarillo from January to October, inclusive. Better yields were obtained than in 1909, however, because the average stands were much thinner. Under these conditions 32 plats of milo and dwarf milo yielded an average of 17.9 bushels per acre, while 22 plats of ordinary black-hulled and red kafirs yielded only 3.7 bushels. The difference in average yield is 14.2 bushels. Even if we admit that half of this difference is due to the dwarfer growth of the milos compared with the standard kafirs, we still have a gain of 7.1 bushels to earliness alone.

"The relative value of earliness and dwarfness are further indicated in results obtained from three strains of black-hulled kafir. The writer has produced by selection an early strain of the black-hulled kafir which is nearly two weeks earlier than the ordinary strains, although of the same height. In 1908, a favorable season, it yielded about 10 per cent less than the average of the ordinary black-hulled varieties. In 1909, however, it yielded 10.7 bushels to the acre, while 20 ordinary strains averaged only 5 bushels and the best of them yielded only

10.9 bushels. In 1910, under the conditions described, it produced 7.57 bushels, compared with 2.95 bushels from 15 standard plats.

"Another early strain, which is also dwarf, growing to a height of about 4 feet, yielded in 1908 about 4.5

Kafir Field, Dodge City, Kansas, Branch Experiment Station, 1911.

bushels less than the average of the ordinary taller and later strains. In 1909 it yielded 14.4 bushels, compared with 10.7 bushels from the tall but early strain and an average of only 5 bushels from the ordinary taller and later strains. In 1910 it yielded 9.28 bushels, while, as noted above, the tall early strain produced 7.57 bushels and the ordinary strains only 2.95 bushels per acre. These figures indicate that in 1909 about 40 per cent and in 1910 about 27 per cent of its increased yields were due to its dwarfness and 60 per cent and 73 per cent, respectively, to its extra earliness.

"As previously noted, the year 1909 was marked by severe drought during July, August, and September, in the southern half of the Great Plains. At the Amarillo Experiment Farm, in Texas, 17 plats of milo gave an average yield of 6.8 bushels, and 10 plats of dwarf milo

an average yield of 11 bushels to the acre. The best plat of milo yielded at the rate of only 16.5 bushels, though in a low piece of ground, while the best dwarf milo yielded 23.2 bushels per acre. In 1910 there was not as much difference. Eight plats of milo yielded an average of 16.2 bushels per acre, and seven plats of dwarf milo yielded an average of 19.6 bushels. The advantage in favor of the dwarf variety seemed to be largely due to the smaller size of the plants and the consequent lower water requirement."

Need of Pure Varieties. The advantages of pure varieties of sorghum crops are important. The purity of the seed normally indicates early maturity and dry weather resistance. Crops grown from seed of pure strains will be more uniform in stand and growth, uniform in height, uniform in ripening, and the yield in grain and forage will be most satisfactory. More uniform planting may be had by using pure strains because of the greater uniformity in size of seed. Such grain will command a better price in the seed markets. The sorghums are more subject to mixing by cross-fertilization than are most other farm crops, the pollen being carried by the wind from the plants of one kind of sorghum to the plants of another kind. However, mixtures frequently result from the carrying of a different kind of seed from an adjoining farm by the threshing machine or in wagon-boxes. Mixing by such means need not worry the farmer in so far as his own seed is concerned, for the very best method of saving seed is that of selecting heads in the field and storing the seed in the head until planting time.

However, cross-fertilization is difficult to control. It is a good plan to grow, so far as possible, only one variety of sorghum crop. This, however, is not in every case practicable. For example, if the farmer is depending upon milo for grain, he needs some of the sweet sorghums or "canes" for roughage, and so the two crops must be grown on the same farm. In such event the

crops should be planted as far apart as possible and the volunteer plants of either should not be allowed to seed. The following of the sorghum grain crop with some other crop, such as wheat, oats, millet or barley, will help to keep the farm free from volunteer plants. It is for these reasons that it is advisable, so far as is possible, to make one kind of sorghum suffice for both roughage and grain. In the sections to which kafir is adapted as a grain crop, it will give satisfactory results when planted for forage. So, on a kafir farm the planting of only one variety of kafir is necessary for the two purposes, and the danger of mixing as a result of cross-fertilization is reduced to a minimum or is at least confined to the possibility of cross-fertilization by plants on adjoining farms. The measure of sorghum crop value depends largely upon the purity of the strain, and every effort should be made to keep the standard of purity high.

Maximum Value in Better Methods. There is a feeling that sorghums will grow anywhere under any kind of careless treatment. True, the sorghums do grow under a wide range of soil and climatic conditions, but in the sorghum belt they will do much better in the future than in the past if the planting and cultivating is done in a more workmanlike manner and if less is left to chance. The sum total of the best results with sorghums is to be found in the best adapted pure varieties and better growing methods. Those things which pertain to better growing are preparation of land before planting, careful planting, the use of less seed, thorough and timely cultivation, and the use of a proper crop rotation, each of which is more fully discussed elsewhere.

GRAIN SORGHUM YIELDS AND VALUES

Since the introduction of grain sorghums their yields of grain and forage have been compared with corn and the value of sorghum crops has generally been measured by this comparison. Even to this date in a considerable portion of the sorghum belt which is not at all adapted to corn, farmers continue to plant corn, indicating that they are not informed as to the yields and income from sorghums as compared with corn. They seemingly fail to realize that the adversities of their climate are such as to make corn an impossible profitable crop. When sorghum belt farmers learn that corn thrives best in those sections where the summer temperatures range from seventy to eighty degrees Fahrenheit, they will then appreciate that corn farming under sorghum belt conditions is an unqualified failure. When this is realized they will then understand that the grain sorghums, for centuries grown in countries which cause the plant to acquire certain qualities which enable it to overcome prolonged dry weather and excessive heat, are the crops they should grow. The neglect to fully appreciate grain sorghum possibilities as compared with corn has cost Kansas and Oklahoma farmers millions of dollars year after year.

Merchant Should Know Sorghum Value. The comparative value of grain sorghums and corn is a matter on which the local seedsmen, bankers and merchants should fix their attention that they may become of influence in directing the use of adapted crops through the cultivation of which the prosperity of their patronizing farmers and their locality will be increased. A dealer in Wallace County, Kansas, in the spring of 1913 sold several hundred bushels of seed of a big variety of Iowa

white corn to the farmers in his locality. This dealer perpetrated a fraud upon his neighbors—he took their money without giving value in return. There was no chance for this corn to mature grain in the county or part of the state in which it was planted, except in an extremely favorable season—a longer growing season, one of greater rainfall and lower temperature than is common to that section. When asked why he obtained such seed, he remarked that it was what his customers wanted.

Cutting Cane with Corn Sleds in Big Field in Western Oklahoma, 1913.

The fault I find with this seedsman is that he absolutely failed to advise his customers as to their needs—as to how they could best pay the bills they owed him. Just such foolish breaks as this are made every year in every locality, and this circumstance shows good reason why merchants, bankers and others should inform themselves agriculturally.

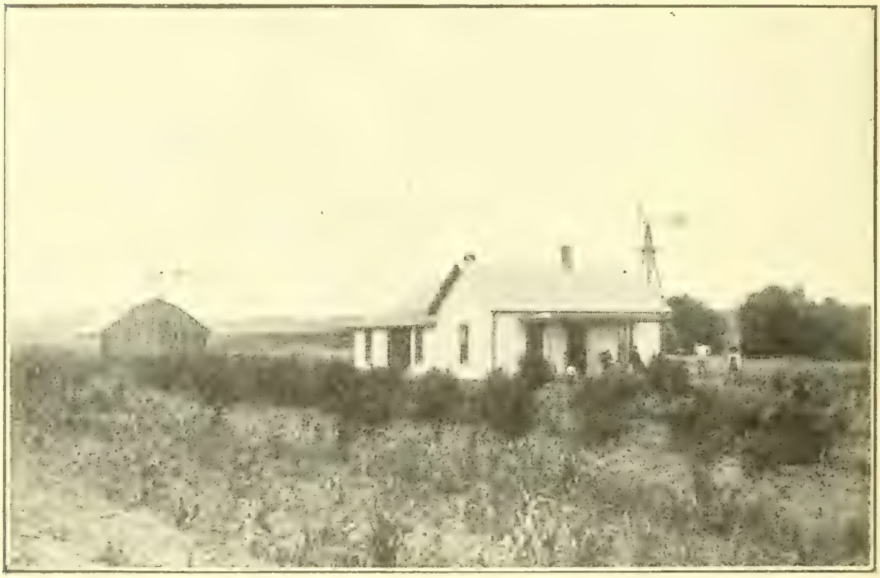
Conversation with a number of those who planted this big white corn developed the fact that they preferred corn because it was readily marketable, whereas they thought kafir and milo were not, and the variety planted was a heavy yielder and would make good money if it gave a crop. I have no doubt these men still hold the same opinion in spite of the fact that in the fall of 1913 I examined in that county several fields of milo and feterita which would yield twenty to thirty bushels of

grain per acre, while corn in the county that year was near a total failure. This is typical of the manner in which the same farmers have for years past sown wheat. When the ground becomes warm in the spring the Plains farmer has a feeling that he must plant something, and apparently does not consider the probable results. When wheat seeding time comes he seeds wheat as long as there is land unseeded and seed to sow. This is a principle too long followed by too many farmers and which must be eliminated from the farming system. In its place must come a determination to plant those crops most certain of giving a return for the labor invested, and a readjustment of conditions by which the farmer can utilize profitably such crops as he can grow.

Yields Inspire Confidence in Sorghums. The yields of both grain and forage of the sorghums are widely varying for the same reason that the yields of corn are varying even in the corn belt. The dry years will reduce the yield—often to almost nothing—while in the wet years they give large yields. The largest kafir yield of which I have a record is that of Orrin McNath, Greer County, Oklahoma, in 1912, which was 124.8 bushels per acre. The land and crop were measured by an agent of the Federal Department of Agriculture. This was a field of pure kafir, the typical high-yielding head prevailing. It is certain that few farmers can obtain such yields, but it is equally certain that for a ten-year period in any section of the sorghum belt the adapted grain sorghums will outyield corn. So, to report the grain sorghum yield for any section on any basis other than averages for a term of years, would mean little.

The records of grain sorghum yields for the various states have not been standardized as in the case of corn and wheat. The fact is that the boards of agriculture of the various states have not as yet taken grain sorghums seriously. In this respect they are less appreciative of their value than are farmers, who have each year increased the acreage. However, such figures as

are available can have no effect other than inspiring confidence in grain sorghums as the most certain crops and would seem to justify a largely increased acreage. I would have it understood, though, that in my opinion no figures here given on grain sorghum yields as compared with corn, and no other statements contained herein can be of as much real value to the farmer as



Sorghums and Live Stock are Making Things Go on This Clark County, Kansas, Farm.

those things he can observe and learn—through a pair of wide-open eyes and a receptive mind—as he goes about among his sorghum belt neighbors, noting those crops most successfully grown and the manner in which they have been utilized in a permanent farming system.

Sorghum Area Each Year Extended. The kafirs and milos are gradually extending to areas outside the sorghum belt, as previously described. The fact is that the sorghums are each year working their way into the corn belt. The acclimatization of milos to Nebraska and the Dakotas is making rapid headway and in these states a gradually increasing acreage is being planted. The use

of kafir as grain and forage is extending to Iowa, Missouri and Arkansas, and it is safe to forecast a constantly increasing acreage for these and other states. When the true value of the grain of sorghums for feeding is recognized, when the value of the whole plant fed as forage or silage is better understood, and the acre yield in tons is compared with corn, the feeders of live stock in the corn belt will become sorghum growers.

Cane and Kafir in Missouri. In Missouri, the saccharine sorghums are principally grown for seed and syrup. The acreage is comparatively small, being only 19,470 in 1912, yielding 408,870 bushels of seed with a value of $396,604, and 1,693,890 gallons of syrup with a value of $880,823, or a total value of $1,277,427 for the entire sorghum crop, and a value of $65.61 per acre for the crop. It is doubtful if the sorghum-growing lands of Missouri could equal this showing if planted to any other farm crop.

For Missouri it is not possible to segregate the kafir acreage from other hay and forage crops with which it is classified. However, from the following table, deductions of interest, and possibly of surprise, may be made. This table is compiled from the 1913 report of the Missouri State Board of Agriculture and pertains to the 1912 crop:

Section of State.	Corn, Bushels.	Av. Price, Dec., 1912.	Kafir, Bushels.	Av. Price, Dec., 1912.	Cane Seed, Bushels.	Av. Price, Dec., 1912.
N. E. 20 counties....	34	$0.417	25	$0.60	30	$0.87
N. W. 21 counties ...	35.1	.406	22	.60	23	.71
Central 21 counties..	36	.436	21	.90	20	.95
S. W. 23 counties ...	24.5	.457	24	.65	21	1.05
S. E. 29 counties....	29	.466	45	.97	12	1.28
State.	31.9	.43	27.4	.74	21.2	.97
Average acre value.	Corn, $13.72		Kafir, $20.28		Cane, $20.56	

The yield of sorghum seed per acre would indicate a large acre tonnage, possibly 15 to 18 tons, and points the live stock feeder of that state to the possibilities in growing sorghums for silage. The attention of Missou-

rians is called to a later chapter setting forth the feeding results obtained from sorghum silage as compared with corn.

It is worthy of note, too, that the acre value of cane seed exceeds the acre value of corn by $6.84, also the acre value of the grain of kafir exceeds the acre value of corn

Grain Sorghum Fed Hogs of Decatur County, Kansas, Grazing while Awaiting Shipment.—City of Oberlin in Background.

$6.56. It is apparent that local conditions governed the price of seed entering into the above figures for both cane and kafir. It should be observed that in the twenty-nine southeastern counties kafir outyielded corn 16 bushels per acre, and that in the twenty-three southwestern counties, just across the line from Kansas, kafir yielded within one-half bushel as much grain per acre as corn.

A comparison of the grain yield of kafir with corn and the known heavier forage tonnage of kafir as compared with corn, will give the feeder a good idea of the relative merits of the two crops in live stock farming. Beyond doubt there are lands in Missouri on which it will pay better to grow kafir and cane than it will to grow corn.

Nebraska Growing Kafir and Cane. The cane crop is of annually increasing importance in Nebraska. Every county in the state, except two, report some acreage in 1913, the greater acreage being in the western section of

the state. The crop is used principally for forage and is fed out of the shock.

The following table compiled from the report of the Nebraska State Board of Agriculture, gives the only obtainable essential facts regarding cane production in that state:

Year.	Acreage.	Acre Yield, Tons Forage.	Acre Value.
1913	126,050	2.1	$12.57
1912	112,171	3.12	24.97
1911	90,673	2.51	20.09
1910	73,654	2.36	....
1909	70,403	2.89	....
1908	67,850	3.09	....

The acre value given above is figured on the basis of $6 per ton. This is a higher value than is usually placed on cane forage, but the Nebraska Board of Agriculture has for three successive years placed that value thereon. For the period 1908-1910 no value is reported in the board's figures.

Kafir is as yet a crop of small acreages in Nebraska, although the acreage is rapidly increasing. The total kafir acreages for four years as shown by the report of the State Board of Agriculture, are as follows: 1910, 9,282; 1911, 11,021; 1912, 22,014; 1913, 23,174. There are only five counties in Nebraska having a thousand acres or more of kafir. These are Furnas, with 4,517 acres; Harlan, with 2,281 acres—these counties lie respectively just north of Norton and Phillips counties in Kansas. Frontier County has 2,492 acres, and Red Willow 3,267 acres, and these lie north of Decatur in Kansas. Thayer County has 1,142 acres, and lies just over the line from Republic County in Kansas. There are nine counties which report no kafir in 1913. Kafir is grown in Nebraska principally for its forage. The Board of Agriculture places no acre value on kafir either for grain or forage, but it would be safe to give kafir forage a value equal to that given the forage of cane.

The above figures will give the reader some idea of the extent to which kafir and cane are grown in Nebraska and are adapted to the use of the farmer of that state. The average yield of cane for the six-year period, as shown in the table above, gives a good idea as to what can be expected of that crop for roughage when grown in the western half of Nebraska, a section not at all adapted to corn except as the acreage may be confined to the bottom lands. For the yields of silage per acre, multiply the average acre yields, shown in the cane table, by three, showing that for silage the yields for a six-year period would run from 6.3 tons to 9.36 tons per acre. As the use of the silo is extended in Nebraska and to the western section of the state in particular, there can be no doubt but that kafir and cane will be extensively grown for silage and will be relied upon as the principal forage crops. The Nebraska reader's attention is called to the use of these crops for silage as shown in a following chapter. The Nebraska figures fail to recognize milo, although plantings of acclimated seed are maturing crops in nearly every Western Nebraska county from the southern to the northern boundary of the state.

Nebraska Experiment Station on the Sorghums. An appreciation of kafir, cane and milo, is given in Bulletin No. 135 of the Nebraska Experiment Station, and is the result of observation and investigation made at the experimental sub-station at North Platte. It is:

"Our experiments during eight years confirm our belief that cane (sorghum) is the chief forage plant where alfalfa cannot be grown successfully. In 1911, when spring small grain was an entire failure, and when 50 acres of corn was put into a 130-ton silo, a ten-acre field of cane following oats gave eleven tons of forage. The average yield during the last eight years has been four tons per acre. In experiments in wintering cattle, the cane proved to be worth fully as much per ton as a good quality of Platte Valley prairie hay. The Early Black Amber is one of the best varieties, and matures here.

"Kafir is a very good forage, probably fully as valuable per ton as cane. It is usually grown in rows, though it does well seeded thickly. The chief objection to raising it is that it does not mature seed this far north and the seed shipped in is often low in its germinating power. It is hoped that the date of maturing may become earlier when it is selected with this purpose in view, but thus far there has been but little kafir seed produced on the sub-station farm.

"Milo has been grown in tests with cane and kafir, but does not have nearly the feeding value of either of the other two. The seed, however, is valuable as a grain for feeding stock. This character of the plant is being developed with the idea that it may take the place of corn in the extreme western part of the state."

In the first sentence in the above paragraph the author undoubtedly refers to the feeding value of the forage of milo as compared with that of kafir and cane.

Kafir and Milo in Colorado. There are no figures showing acreages or yields of kafir, milo or cane for Colorado. I have, however, traveled throughout that portion of Colorado east of the Rocky Mountains, and as a result of this personal observation and contact with farmers, together with letters received from many Colorado settlers, I am convinced that the grain sorghums will meet the need for grain and forage crops in Eastern Colorado. On those farms on which cows are milked or other live stock is kept, milo and feterita for grain and kafir and cane for forage, are now and have for years been the dependable crops.

Acclimated milo matures in Colorado east of the mountains from the south to the north line of the state. Upon the Arkansas Divide the maturity of milo for grain is uncertain. This divide reaches its highest altitude in Elbert and El Paso counties and is that part of the Eastern Colorado plains the waters of which flow east and south to the Arkansas River, and east and north to the Platte. The altitude of this divide is so great as to make the

growing season too cool and short for milo maturity in other than exceptional seasons. "Milo should have the same place as a feed grain in dry land farming in Eastern Colorado that corn has in Iowa and Illinois," was the gospel preached by H. M. Cottrell, the Director of Extension of the Colorado Experiment Station, some five or six years ago.

Kafir in Colorado is sure of maturity only in Baca County, which is the southeastern county of the state. However, it usually matures seed in all of the Arkansas Valley. It supplies forage in good quantities for hay and silage throughout the eastern slope. Cane produces forage and silage east of the Rocky Mountains, and kafir and cane drilled reasonably thick in rows three to three and one-half feet apart, will yield silage or a fine quality of forage in profitable quantities most years if proper planting and soil cultural methods are followed.

In the lower altitude fruit districts around Grand Junction and Montrose, kafir and milo mature grain and promise much for the further prosperous development of these sections.

This statement is from a bulletin of the Colorado Experiment Station: "Milo will yield more grain per acre than corn in most of the Eastern Colorado plains." The corn to which reference is made is a native variety. It is an early maturing, dwarf corn, rarely growing higher than four feet and ears eighteen inches to two feet above the ground. The ear is small, usually solid, but in a dry year is wormy and poor feed. The yield ranges from nothing, some years, to as much as thirty bushels per acre in the most favorable seasons. This corn is the only competition milo has on the Eastern Colorado slope and, in reality, is not a competitor except that it produces a more palatable forage, but usually less acre tonnage than milo. The forage of milo is used in Colorado for horses, cattle and sheep, and is relished by these animals. It is not amiss to here state that the seed

of kafir, milo and feterita planted in Colorado should be home-grown if best results would be obtained.

Colorado Station Reports Sorghum Areas. The following statement by Alvin Keyser, agronomist of the Colorado Experiment Station, sets forth the specific localities adapted to kafir and milo. "Kafir and milo are not uniformly adapted to Eastern Colorado. In the extreme southern part of the state along the Arkansas Valley and in the east central part at altitudes not greater than 5,000 feet, these crops are adapted for grain and forage. They will grow occasionally at higher altitudes, but are not uniformly successful, as the seasons are too short and too cool for their best development. They are not uniformly successful in the northern part of the state. In other words, the section where these crops are adapted is limited to Baca, Las Animas, Pueblo, Otero, Crowley, Bent, Powers, Kiowa, Cheyenne, Kit Carson, a portion of the southern part of Luma and Washington counties, and a portion of the southern part of Lincoln County. There are some localities at other points in our plains region where these crops do well, but for the most part in the remaining counties of the plains the seasons are too short and the nights too cool to permit development for other purposes than forage. Seed will frequently not ripen even with milo, which is the earlier maturing of the two crops."

Grain Sorghums Yield Double Corn. A Limon, Colorado, reader wrote Kansas Farmer in November, 1912: "Last spring we planted four varieties of grain sorghums and five varieties of corn. All received as good culture as could be given. The past season has been one of the best this country has ever had. The corn shows small yield of grain, none of the varieties yielding more than ten bushels per acre. Each variety of corn was supposed to be adapted to this climate and soil. The grain sorghums are all showing good yields. The lowest yielding variety will make more than double the amount of grain

which the best variety of corn will give and all sorghums have far exceeded the corn in quantity of fodder."

Grain Sorghums in the Panhandle. For the Panhandle of Texas corn is not to be considered as a grain or forage crop when compared with the grain sorghums. It has proven the poorest grain crop of the Panhandle. When corn does give a fair yield the grain is so badly

Red Polled Cattle, Sorghums and Intelligent Effort Made This Comfortable Farm Home in Phillips County, Kansas.

worm-eaten that it has no value except for hog feed. The grain sorghums, however, are so well adapted and are such profitable substitutes for all purposes that there is no reason why the Panhandle farmer should attempt corn-growing. The Panhandle includes 47 counties in Northwest Texas, the elevation ranging from 2,000 to 4,000 feet. The annual precipitation varies from eighteen to twenty-three inches, the greater part of which falls during the spring and early summer months. Throughout this section the evaporation is great, the mid-day temperatures high, and the nights relatively cool. It is in this part of Texas that the Federal Department of Agriculture is doing its most important work in the selection and development of improved kafirs, durras and milos.

Experiments during 1903 to 1906 at Channing, Hartley County, are reported in Federal Bureau of Plant Industry Bulletin No. 283, as follows: "In a test of many varieties of corn the average yield of the best variety in a three-year period was less than 40 per cent of the yield of milo. Milo and kafir prove good yielders of grain, the three-year average yield of milo being 42 bushels."

In the same bulletin are reported trials at Amarillo, beginning with the year 1905, as follows: "The results in tests of corn during the six-year period show it not to be adapted to the Panhandle country. The best variety, a June corn, yielded 11.8 bushels and only three varieties exceeded eight bushels per acre on an average during that time. Omitting the results of one season, a locally-grown red dent has yielded slightly better than the June corn.

"The grain sorghums are the most dependable crop that can be grown in the Panhandle. In the five years, 1907 to 1911, inclusive, the average yields of all varieties of milo were 23.5 bushels, while all varieties of dwarf milo in the last four years of this period yielded an average of 27.8 bushels. Black-hulled and red kafir made an average yield of 20 bushels in the six-year period, 1906 to 1911, excluding 1907 in the case of red kafir. Varieties of durra and kaoliang also made good yields. About three pounds per acre is the proper rate of planting, and the best date in the vicinity of Amarillo is about May 20, varying, however, with the season."

Experiments at Dalhart reported in the same bulletin are summarized as follows: "Grain sorghums such as milo, dwarf milo and black-hulled kafir have given profitable yields at Dalhart, although not so high as at Amarillo."

Numerous tests and observations at Chillicothe, in Hardeman County, east of the Panhandle proper, at an elevation of 1,500 feet and having an average rainfall of twenty-three inches, are summarized in the above bulletin as follows: "The grain sorghums are important

and completely adapted crops, milo, dwarf milo and black-hulled kafir being largely and profitably grown."

The reader should keep in mind that in Western Texas are the same variations in rainfall, altitude, and the same moisture-dissipating forces as exist in Western Oklahoma and Western Kansas, but that the growing season is longer. However, the rainfall occurs in the early part of the growing season, the latter part being dry, and there is the same necessity for early-maturing crops as in the western section of Kansas and Oklahoma, and farm practice has established the early-maturing varieties as the best yielders.

It should not be inferred that the value of the grain sorghums for Texas is confined to the Panhandle. They may be grown with as much profit and assurance east of the Panhandle country as in those parts of Kansas and Oklahoma lying east of the 98th meridian. In Texas, as in Kansas and Oklahoma, the general use of grain sorghum crops and the growing of live stock is being urged upon the farmer.

Kansan's View of Texas Kafir Growing. The staked plains of the Southwest are sure enough "carrying coals to Newcastle," when, as we know, they are supplying the most fertile sections of Texas and other parts of the South, with grain. In March of 1912, a farmer of Sheridan County, Kansas, wrote in Kansas Farmer:

"I have returned from the Panhandle of Texas a firm believer in the value of kafir as a forage and grain crop for the western half of Kansas. While in the Panhandle I saw carload after carload of kafir being shipped to the coast and river sections of that state—the black land of Texas which would grow corn if they would give it a chance. Think of it! The staked plains growing more grain than it needs and feeding the mules of the farmers on the black rich lands. If kafir will grow on the plains of Texas, it will do much better in Sheridan County, Kansas, if we give it a chance."

Grain Sorghums in Oklahoma. Although Oklahoma

is second—ranking next to Kansas—in kafir production, the figures regarding acreages, yields, value, etc., must be taken from scattering sources. The State Board of Agriculture does not have figures of value in determining the acre yield in bushels because that acreage planted in season for grain is not reported separately from that grown only for forage. In Oklahoma much kafir is planted as late as the middle of July and from which a grain crop is not expected. This acreage is included in the table below and makes the acre yield of grain correspondingly low. This table is compiled from the board's report:

Year.	Acreage.	Yield in Bushels.	Average Acre Yield in Bushels.
1911	606,462	8,106,991	13.37
1910	454,146	4,530,086	9.97
1909	482,214	2,255,470	4.67
1908	400,047	3,708,177	9.26
1907	317,405	5,000,237	15.75

In 1913 the Oklahoma kafir acreage was near a million, that state producing much more kafir grain in that year than did Kansas, because of generally better selected seed and timely rains in advance of killing frosts.

Even though a tremendous kafir acreage planted late and for forage only and which produces little or no grain, is taken into account in the figures above and the acre yield thereby greatly reduced, the yield of kafir does not suffer seriously in comparison with corn as shown by this table compiled from the United States census and showing corn acreages and yields for five years:

Year	Acreage	Bushels Per Acre
1913	4,750,000	11.0
1912	5,448,000	18.7
1911	5,675,000	6.5
1910	5,735,000	16.0
1909	5,914,069	15.9

It is certain that the corn of Oklahoma is grown on the best lands of the state under the heaviest rainfall. The product of such land enters into the corn yields shown above in a much greater proportion than in the kafir table next above printed. When the best lands and the heaviest rainfall are compared with the poorest

Sheep Do Well in the Sorghum Belt and Deserve the Farmer's Patronage.—The Choice Few Shown in the Picture were on a Russell County, Kansas, Farm.

lands and lightest rainfall, the kafir yield, in spite of the Oklahoma Board of Agriculture's way of compiling statistics, makes a favorable showing. At any rate it is doubtful if any profit can be figured from such corn yields.

For 1912 the Oklahoma demonstration farms of the Federal Department of Agriculture, and which are located in twenty-seven counties, report the yield of kafir on those farms as 32.7 bushels per acre, and of corn 23.3 bushels, or 40 per cent in favor of kafir.

At the Stillwater, Oklahoma, Agricultural Experiment Station, the average yield of corn from 1900 to 1903,

was 11.2 bushels and of kafir 27.02, or 141 per cent in favor of kafir. In 1911 at the same station corn yielded nothing, milo 39 bushels per acre, red kafir 42 bushels, and black-hulled 56 bushels.

I had hoped to be able to obtain figures from the Panhandle School of Agriculture at Goodwell, Oklahoma, located in the extreme western county of Oklahoma and adjoining Morton, the southwest county of Kansas. This institution was only recently established and its organization for work in field crops is not yet perfected. However, the president, S. W. Black, wrote:

"Our elevation is 3,300 feet, our annual precipitation is between 16 and 19 inches, for which reason we have not succeeded in raising much corn at this station. Our average yield of corn would be very low. Within the last three years we have tried out over 60 varieties of corn, many of which did not produce ears at all. The best yield of corn we have had was 34 bushels per acre. It was badly worm-eaten and while the fodder was very good, it was a very poor yield. We have grown as high as 72 bushels of white milo to the acre. That same season we grew 66 bushels of brown milo and about the same number of bushels of dwarf black-hulled kafir."

The actual feeding value of an acre of kafir and of corn—and that should be the measure of value for all good farmers—could not be better shown than by the following tables taken from the 1910-1911 report of the Stillwater, Oklahoma, station. These crops were grown on unmanured, medium upland soil:

KAFIR PER ACRE.

Year	Pounds of Stover	Pounds of Grain
1900	4,600	1,744
1901	4,230	1,506
1902	4,500	1,154
1903	4,360	1,620
Average for four years	4,422	1,506

CORN PER ACRE.

Year	Pounds of Stover	Pounds of Grain
1900	3,260	1,063
1901	1,380	5
1902	1,424	1,440
1903	1,740	979
Average for four years	1,951	872

When in Shock This Graham County, Kansas, Wheat Field Indicated a Yield of at Least 15 Bushels per Acre.—The Land Was Summer Fallowed and This Was the Only Field of Wheat in the Neighborhood Harvested in 1913.

"In reviewing these figures," says the report, "it will be seen that corn was a complete failure during the season of 1901 from the standpoint of grain production, while kafir gave very fair returns. Again, taking the yields which are given for corn for four consecutive years, wide variations are apparent both in yield of grain and in yield of stover. With kafir, however, the results are quite uniform throughout the entire period. The average yield of kafir for the four years was 634 pounds per acre in advance of the average yield made by the

corn. The difference in the average amount of stover produced by these two crops was 2,471 pounds in favor of kafir.

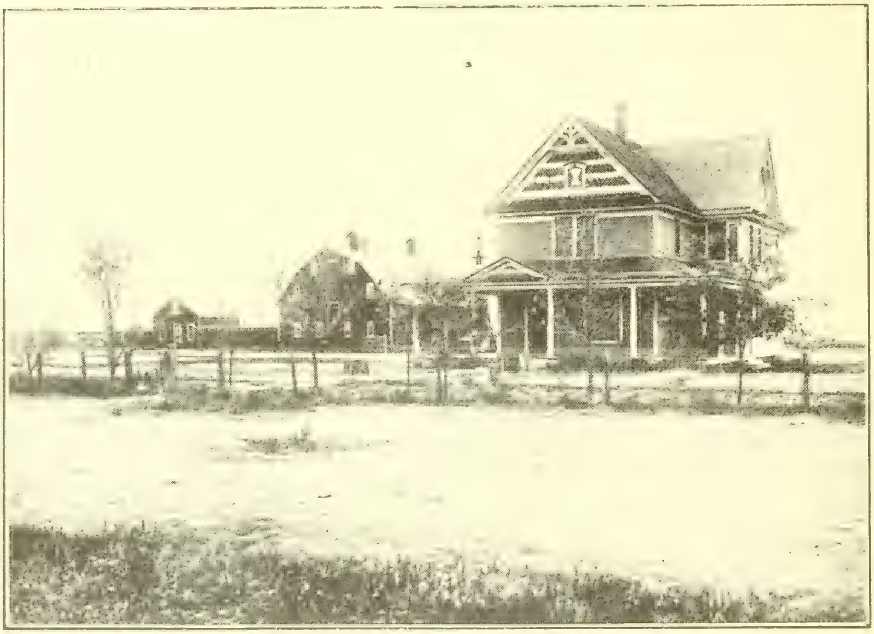
"This study brings two important facts to our attention. First, kafir has given fair yields under unfavorable conditions, and for upland types of soil may be depended upon to give better results than corn. Second, the hot, dry weather which occurs about the time that corn is tasseling is very detrimental to the process of fertilization. This in part is an explanation for the exceedingly low yields reported for corn during certain seasons."

While kafir is the big grain sorghum crop of Oklahoma, milo is each year increasing in importance. With Oklahoma it is only a question as to the area to which it is better adapted than kafir. In the extreme West and Southwest, in the area of proven adaptability for milo, the cultivation of corn is not to be considered from a financial point of view. Since the forage of milo is not so valuable as that of either kafir or cane, the latter two should be grown for silage or forage in the sections in which milo is grown for grain. Fortunately, kafir and cane make good forage crops in all parts of Oklahoma and the live stock-keeping farmer can, if he will, have "sure feed crops" for both grain and forage.

Why Oklahomans Should Plant Kafir. Johns Fields, editor of the Oklahoma Farm Journal, has spent his life in an endeavor to induce Oklahoma farmers to place their trust in kafir. In 1899 he wrote:

"Corn or kafir, which? It depends upon where and for what purpose the grain is to be grown. On bottom land when the crop is to be sold as soon as matured, plant corn. It is always a marketable article at some price, depending usually on the volume of the local supply. If the grain is to be fed to stock, it would seem advisable to replace a portion of the corn by kafir, especially for the large amount of rough forage which the latter affords. On upland, corn is not a sure crop while kafir

has not yet, even in the driest seasons, failed to yield well. In 1897, when dry weather, high temperature, and hot winds affected the corn so that no well-developed ears were produced, kafir planted alongside yielded from 25 to 53 bushels of grain per acre. In 1898 when corn did well, kafir surpassed it on upland, one plat yielding



Registered Red Polled Cattle are Bred on This 420-Acre Farm in Ness County, Kansas.—These Buildings Would Do Credit to Any Corn Belt Farm.

at the rate of 102 bushels of kafir per acre. On bottom land, plant corn or kafir; on upland, plant kafir."

Fourteen years later I asked if he still stood on the above quoted statement, and he replied:

"It was true then, has been true ever since, and it is true now. That is a characteristic of real facts about agriculture, or anything else. The only modification necessary to bring this statement strictly down to date is that in the twelve years since it was written, the market for kafir has developed until it sells for as much as corn and sometimes more."

Kafir Pays Rent in Oklahoma. The value of kafir as a sure grain crop and for the production of forage necessary for the farm live stock, and the extent to which it can be depended upon by the farmer as well as by the creditor who must look out for his security, is well shown by the action of a farm loan company which has done business in Kansas since 1881 and in Oklahoma since 1889 and which company writes that it has adopted the following plan:

"We have for three years been refusing to lease land under our charge to a tenant who will not put at least one-half of the land intended for corn, to kafir, the black-hulled variety being preferred. On one farm, Kay County, Central Oklahoma, the tenant had in 1911 one hundred twenty acres of corn which made thirty bushels to the acre. On this same farm were one hundred acres of kafir which made sixty bushels to the acre. The land was of the same quality. We write it in the lease that the tenant shall plant as much kafir as he plants of corn."

Kafir and Milo in Iowa. In 1910 kafir was grown on sixty-six farms in Iowa. The total acreage was 142, yielding 3,081 bushels, and valued at $2,083. The average yield was 21.7 bushels per acre, and the average acre value $14.66. The average acre value of corn for Iowa that year was $18.16. Later reports made by the State Department of Agriculture reveal that milo has been added to the farm crops of that state. The department's figures include kafir and milo with other miscellaneous crops, and it is impossible at present to make an individual showing for either. However, the facts are that the Iowa farmer is finding the grain sorghums, as well as the canes, of value in his feeding operations, and it is reasonable to expect that the sorghum acreage will be increased.

Kansas Grain Sorghum Growing. Since the introduction of grain sorghums into the United States, Kansas has led all other states in the acreage planted and in crop value. It was in 1893 that the Kansas State

Board of Agriculture first took official notice of grain sorghums and included in its statistical report figures showing the extent to which kafir, milo, and "Jerusalem corn" were then grown. In that year the kafir acreage was 46,911, with a value of $450,903; milo acreage, 14,-004, value $121,331; "Jerusalem Corn" acreage, 17,027, value $80,886. Thus in 1893 the first grain sorghum acreage officially reported was 77,942 and the value thereof $653,120. These figures were compiled under the supervision of Martin Mohler, then secretary of the board. Twenty years later, in 1913, the acreage of kafir had increased to 1,403,731, with a value of $12,324,131; milo 229,534 acres, value $1,189,643; and the Jerusalem corn had decreased to 4,434 acres, with a value of $23,-737. Therefore, in 1913 there was grown a total acreage of grain sorghums amounting to 1,637,699, with a total value of $13,537,511. However, the largest kafir and milo acreage during the period was that of 1912 in which there were harvested 1,605,725 acres having a value of $21,935,959. During this time the corn acreage held about stationary, being 6,172,462 in 1893 and 6,655,023 in 1913, although for several years during the period the corn acreage planted was in excess of eight million.

In Kansas the grain sorghums have not failed to produce at least a fair forage crop. There have been years when the grain crop was almost a failure, but probably no other year in which the failure was so near complete as in 1913. Even in that year there were occasional good yields of grain sorghums in every county in which they were planted. The performance of the grain sorghums in Kansas indicates that the individual grower is more responsible for poor crops than have been any seasonal conditions yet experienced. In other words, a near failure of a grain crop of the sorghums is the result of careless farming to a greater extent than of seasonal conditions, barring, of course, injury to the crop by hail or insects. The same thing is true in the case of corn—in a lesser degree, however. Figures which are later sub-

mitted give proof of this statement. The experience and observation of the wide-awake farmer will establish this claim to his satisfaction. A farming residence of thirty years within the state, with an opportunity for wide observation of sorghum and corn-growing conditions, gives all the proof I require.

A careful review of the later figures will reveal that there has been no year in the past thirteen when the farmers of Kansas could not have grown the roughage necessary to carry their live stock through the feeding season. The sorghum acreage has not every year been sufficient to supply ample of the necessary roughage, but this has been the fault of the grower and not of the crop. In the years 1901, 1911 and 1913, the poorest corn years Kansas has experienced in the past thirteen—1901 and 1913 probably being the poorest corn years in the history of the state—the roughage of sorghums saved the day for Kansas stockmen. The keeping of live stock on every farm is regarded as essential and it is certain that this cannot be accomplished at greatest profit without the most certain feed supply; the sorghums are those crops which will most surely provide such supply. The reason kafir yielded forage in fair quantities and matured grain in some fields in every county in which it was planted in those years when corn failed, was because of its ability to survive the severe dry and hot weather and await the late rains, after which it grew until killing frosts. A plant possessing such characteristics deserves the appreciation and the patronage of every farmer who would have an assured feed supply and a sufficient acreage of such should be planted each year to insure that supply.

In Kansas the value of the crop can be greatly increased by the use of pure seed of the several strains, by thinner planting, better cultivation, and all-around more thoughtful handling. The farmers of Kansas, and in fact of the entire sorghum belt, are just now entering upon the era of grain sorghum usefulness. There is probably still

much to learn regarding sorghum growing and it is certain that much of what is now known must yet be put into practice. Corn will always be an important crop in Kansas, but it is not a sufficiently certain crop throughout the state to justify the live stock-keeping farmer wholly

The Milking of About Thirteen Cows the Year Around Is Giving This Meade County, Kansas, Farm an Income of About $55 per Month. —The Owner Is Each Year Selling a Few Hogs, and Cattle and Wheat Besides.

depending upon it for grain or forage. The use of grain sorghums to the point of growing the necessary feed for such stock as the Kansas farmer can and should keep, will greatly increase the prosperity and permanency of Kansas farming.

Kansas Station Kafir and Corn Yields. The only obtainable complete farm record of Kansas corn and kafir yields for a period of years is that of the Manhattan, Kansas, Agricultural Experiment Station. During eleven years—1889 to 1899, inclusive—the average acre yield of kafir at that station was 46 bushels, and of corn 34.5 bushels. The highest yield was 98 bushels of kafir and 74 bushels of corn. Only one year of the period was

regarded as a grain failure for both. In that year corn produced only a ton of forage per acre, while kafir produced two and one-half tons. Note this yield of kafir forage.

The station record for 1900 to 1902, inclusive, is not obtainable. The record of black-hulled kafir and Kansas Sunflower corn for ten years, 1903 to 1912, inclusive, is as follows:

YEAR.	BUSHEL YIELD KAFIR.	BUSHEL YIELD CORN.
1903	39.8	70.09
1904	38.48	47.64
1905	68.08	47.09
1906	59.93	86.20
1907	47.56	54.01
1908	46.65	58.03
1909	42.62	52.99
1910	60.	*20.
1911	30.	30.
1912	71.3	69.2
Average	50.44 bushels	53.52 bushels

*The best yield of corn in 1910 was Hildreth, 42 bushels.

It will be observed that for the 1903-1912 period the average corn yield is three bushels in excess of the average kafir yield, as compared with an average yield of kafir of 11.5 bushels in excess of corn for the 1889-1899 period. Inquiry as to the probable cause for the better showing for corn, as compared with kafir in the latter period, brought this explanation from A. H. Leidigh, assistant professor in crops: "In the period 1889 to 1899, we had weather very unfavorable for the production of corn, when you consider these years on the average. Our experiments at that time were being conducted on land not very suitable to corn production. In the period 1903 to 1912, we had seasons extremely favorable to corn with the exception of the last three years. The

soil used was much more adapted to the crop than that which had been used in the former ten-year period. In the period from 1903 to 1909 there was practically no loss from chinch bugs, and very little loss in 1910, 1911 and 1912, whereas in the former ten-year period the losses had been heavy. The chinch bug losses in that period affected the corn more than the kafir."

The Sorghum Belt Grows Mules, Too.—They Grow and Fatten on the Buffalo Grass and the Sorghums and Never Fail to Make Money for the Man Who Grows Them.—These Are the Product of Western Kansas.

I would have the reader note from Mr. Leidigh's statement that the results for the first period of ten years, during which time the kafir average exceeded the corn average 11.5 bushels, were obtained, first, during years unfavorable to corn; second, on land not adapted to corn; and third, that kafir withstood the ravages of the chinch bug more successfully than did corn. Each of these three points is worthy of consideration by every farmer who does not have "corn land under a corn sky." In these points lies the reason why more kafir should be grown on every Kansas farm. It is certain that the average of much of the land planted to corn in Kansas is not as good corn land as that on which the corn on the Manhattan Station farm was grown, also that it is impossible to know which are to be the good corn years and which the poor, and that the chinch bug will for all time do more or less damage.

Mr. Leidigh continues: "In the period from 1903 to 1912, with the exception of 1910 to 1912, the cultivation, care, and general conditions were more favorable to corn than to kafir, whereas in the first named period the general supposition is that the crops were more nearly on an even footing." Here is a point worth noting. In the period in which kafir outyielded corn 11.5 bushels per acre, "the crops were more nearly on an even footing" than during the later period when the yields were near equal. In this point is involved the difficulty of a fair comparison of kafir with corn, because in general practice the corn is grown on the best lands, is more carefully planted and better cultivated.

I asked if the corn grown in the last ten-year period was not better adapted to the conditions existing at Manhattan than the corn grown in comparison with kafir in the first named period, and Mr. Leidigh replied: "I believe there is some ground for the supposition that the corn yields in the last period are comparatively high because of more adapted strains of corn. The yields given for the first period were in some cases for varieties which we later found to be unsuited for our conditions."

Attention is directed to that part of the table showing the acre yield for the 1903-1912 period. Therein is a pointer for corn growers, showing the need of better corn-growing methods. It will be worth while for Kansas corn growers to check their corn yields for those years with those of the station farm. Many will note that their yields have been much lower than the yields reported, and it is fair to assume that the difference can be largely eliminated. Much of the corn grown in Kansas is of varieties not well adapted to the conditions of soil and climate, and much of it is of low yielding strains or varieties. There is need for a revival of interest in corn growing. It is certain that not only increased yields but a greater crop assurance can be had through the use of better seed, proven adapted varieties, better planting and cultural methods.

The reader should study the above table carefully. Its teachings are significant. It is recorded that for ten years, a period as favorable as we have any reason to expect for corn or other crops, the yield of black-hulled kafir is only three bushels less than that of adapted strains of corn. When the uncertainty of the seasons is taken into consideration and the superiority of kafir as evidenced in the unfavorable years of 1910 and 1911, the use of kafir for grain and forage is much more certain than that of corn. The table takes cognizance only of the grain yield of the two crops. The yield of stover is not considered. It is well known, however, that most years—favorable as well as unfavorable—the forage yield of kafir is considerably in excess of corn, and this is important from the viewpoint of the live stock farmer.

Kansas Station Yields for 1913. Interest will naturally follow the performance of kafir and other sorghums in the year 1913. The adversity of such crop growing season will long be remembered by farmers who were poorly prepared for such year. Accurate comparative forage yields for 1913 can be obtained only from the Manhattan, Kansas, Experiment Station and branch stations. I have heard and expect to continue to hear the experiment station records criticised. But tell me, if you will, where comparative yields of grain or forage of any crop for any considerable period can be obtained except from such sources. I have been unable to find a farmer in Kansas who could give such figures. Because the figures cannot elsewhere be had, is the reason so many experiment station figures are here used.

At the Manhattan Station all the corn and kafir grown in 1913 was cut for silage. The following figures are the acre ton yields of silage from fields planted on second bottom land: Corn, 4 tons; black-hulled kafir, 5.3; and Orange cane, 10.4.

At the branch station at Dodge City corn and kafir both failed to yield grain. The following yields are of

cured forage: Corn, failure; kafir, nine-tenths ton; cane, one ton.

Corn was hailed out at the Garden City Branch Station. The yield of cured forage of kafir was twenty-four hundredths of a ton, and of milo twenty hundredths.

At the Hays Branch Station corn was a failure, but kafir yielded 3.5 tons of silage per acre.

The Tribune Branch Station reports yields of grains. Local showers fell there during the growing season. The tons given in the table below are for dry forage:

	FORAGE	GRAIN
Corn	.5 ton	2 bushels
Kafir	3.0 tons	12 bushels
Cane	1.5 tons	18 bushels
Milo	.8 ton	5 bushels

The cane reported above was Freed sorghum, regarding which B. S. Wilson, assistant in co-operative experiments for the Manhattan Station, says: "This is a light forage producer and is especially adapted for seed production in Western Kansas."

Special note should be taken of the silage yield for 1913 at the Manhattan and Hays stations. These should be encouraging to the silo user and should encourage the farmer without a silo to construct one or more as a means of saving all of the plant with its highest feeding value. With a yield of 3.5 tons of kafir silage at Hays and 5.3 tons at Manhattan, in a season such as 1913, it would seem that there is no good reason for a shortage of roughage any year. It should be remembered, too, that in each instance the yield reported is for a large field and not for a small plot. To arrive at the yield of silage per acre produced at Dodge City, Garden City and Tribune branch stations, multiply the dry forage yield by three, and such calculation will give the reader a fair understanding of what he can expect under such conditions as prevailed last season in the territory represented by these stations. I insist that the farmer is not doing as well as he can until he has closely approached

these station results. So to do may require somewhat more labor than is usually given the grain sorghum crop, but it is to be presumed that a planting is made for a crop, and it is business to complete the job by pushing the crop to a maximum yield.

Cattle Feeding Scene in Western Kansas.—On This Ranch the Sorghums Have for Years Been the Mainstays.

Thirteen Years of Corn, Kafir and Milo. The record of the performance of kafir and milo as compared with corn for the entire state, has therein some illuminating facts. The total acreages and total values appearing in the tables below are from the reports of the State Board of Agriculture and are the basis for the deductions made. It is unfortunate that figures are not obtainable showing yields for the sorghums in bushels of grain per acre. The board's figures have been made on the basis of ton yield per acre, the value combining that of both grain and forage. While on hundreds of Kansas farms kafir and milo have for years been grown for grain and have been urged upon the farmers of Kansas generally as the most certain and profitable feed crops, the essential figures for intelligently comparing them with corn, are not available. However, beginning with 1915, the board will report the bushel yield of that part of the

grain sorghum crop planted for grain and the acre tonnage yield of that acreage planted for forage.

In 1894, and for that year only, the yields of the grain sorghums were reported by the board in bushels, as shown by the first table below. With these figures is also reported the ton yield per acre for 1893, the first year in which grain sorghums were officially recognized in Kansas' statistics.

	1893 Acre Yield in Tons	1894 Acre Yield in Bushels
Milo	2.47	12.62
Kafir	2.74	13.22
Jerusalem Corn	1.58	13.34
Corn	19.22 bushels	10.45 bushels

The tables below are designed to enable the reader to make a comparison of acreages and acre values of the several crops for a period of thirteen years, 1901-1913 inclusive. It is probable that this period was one of as generally favorable seasonal conditions as Kansas has ever had or can hope for. It would have been possible to select a series of years more favorable to corn and another series more favorable to kafir and milo, but a fair presentation of the merits of the two crops is better shown by results of a period of average seasonal conditions. However, it is impossible even by this care, to place corn and the grain sorghums on an absolutely equal basis for comparison. This is because it is well known that in Kansas the sorghums are planted on the higher and less fertile lands and in the sections of lighter rainfall, while the most fertile lands and those best supplied with moisture are planted to corn. Another condition which makes an equal comparison impossible, is that in Kansas, as in Oklahoma, a considerable acreage of grain sorghums is planted for forage only, thus reducing the acre value of that part of the crop planted for grain and which because of its seeding would have a higher value.

Another cause for impossible accurate comparison is that the figures on corn do not attach a value to the corn stover, when cut and shocked or placed in the silo as much of it is, or when the stalks are pastured as most of them are. It would be just to corn to give an average value of fifty cents per acre for stalk pasturage and to credit it with a value per ton for stover almost equal to that given kafir and milo forage. However, the forage of kafir is worth more per ton than corn fodder and that of milo somewhat less. The value of corn stover per acre would not equal the value of kafir stover because ordinarily the tonnage of kafir is in excess of that of corn. This difference in acre tonnage is generally recognized, and figures herein show that in a series of years at the Oklahoma station the yield of kafir stover per acre exceeded that of corn by one and one-fifth tons. Other figures pointing to the larger acre yield of kafir forage as compared with corn are contained herein.

At any rate the figures available are not such as will enable anyone to place the growing of kafir, milo and corn on an equal basis for comparison. If the bushel yield of kafir and milo planted and harvested for grain were comparable with the bushel yield of corn in the same county, accurate conclusions as to the comparative profitableness of grain yield, could be drawn. Yet, when the feeding value of the grain and forage is considered, common usage, as exemplified by farm practice, has long since determined the grain sorghums as most profitable for the state as a whole, and their greater assurance of yield is also much to their credit. After all, the feeding value and certainty of production is the true measure of any crop which is ultimately fed to live stock.

Corn. The table below shows the total acreage, total value and acre value of the Kansas corn crop for the years 1901-1913 inclusive:

Year	Corn Acreage	Total Value	Acre Value
1913.	6,655,023	$13,378,475	$ 2.01
1912.	6,884,044	83,483,681	12.13
1911.	7,760,087	59,599,408	7.68
1910.	8,589,682	76,402,327	8.89
1909.	7,711,879	83,066,905	10.77
1908.	7,057,535	82,642,461	11.70
1907.	6,809,012	63,040,743	9.26
1906.	6,584,535	65,115,203	9.89
1905.	6,799,755	68,718,583	10.10
1904.	6,494,158	50,713,955	7.81
1903.	6,525,777	57,078,141	8.74
1902.	6,990,764	78,321,653	11.20
1901.	6,772,973	21,731,215	3.21
	91,635,224	$803,292,750	
		Average acre value	$8.76
1893.	6,172,462	$ 32,621,762	$5.29

The figures show that in only one of the thirteen years was the acre value of corn in excess of $12 and that for four years only was it in excess of $10. These yields, even for the entire state and including all kinds of land and farm management, show little profit in growing corn for market. When these averages are compared with the individual higher yields in every locality, it would seem that thousands of Kansas farmers could well afford to examine carefully into their corn growing methods, the adaptability of the crop to and the seed used in their locality, with a view to increasing the yield and the profitableness of the crop. In the poorest years, in fact every year in certain sections of the state, much of the corn is chaffy and wormy and the average acre value does not indicate marketable corn, and the figures given do not show either how good or how poor the crop of

each of the thirteen years was. While the above condition was true regarding the corn crop in a considerable portion of the state, on the other hand much of the land of Kansas is situated as favorably in every respect as any land in the so-called corn belt and produces as large and profitable crops as land in Missouri, Iowa or Illinois.

Harvesting Kafir Seven Miles West of Salina in 1912.—This Kafir Yielded in Excess of 60 Bushels per Acre, Although Not of a Pure Strain.

Regardless of the low average acre value for the thirteen-year period, the aggregate value of corn is far in excess of the value of any other grain crop grown in Kansas. The figures above reporting its annual value from a market standpoint, do not indicate its real value when measured by the pork, beef, butter fat and eggs it produces. Yet the figures indicate a tremendous acreage returning a low value per acre and which can beyond question be greatly increased—I think near doubled—by more intelligent handling of the crop.

Cost of Growing Corn. The corn table above will have additional interest and meaning when the reader reflects on the cost of growing corn. It is quite impossible to produce an accurate statement, for the state as

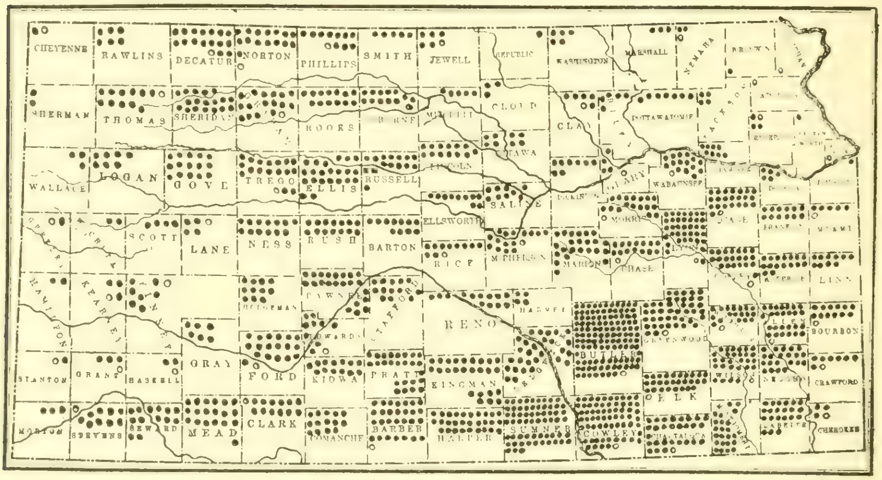
a whole, of the cost of producing a corn crop on account of the widely varying practices regarding corn growing. There are sections of the state in which no less than three times as much work is done on the crop as in other sections. Also the value of land and cost of labor varies. However, it would seem that the following cost statement compiled from the figures of many farmers, could not be far wrong as representing an average amount of labor and cost in growing an acre of corn:

Blank listing	$ .50
Listing at planting	.50
Two harrowings	.30
Three cultivations	.75
Husking 20 bushels	.60
Interest on investment in team and implements	.50
Seed, $2.50 per bushel	.50
Interest on $50 land at 6 per cent	3.00
Total acre planting and growing cost	$6.65

This cost schedule is not intended to indicate the necessary operations in preparing land for planting or in taking care of the growing crop, but corn farming is not as well done anywhere as it should be without at least equivalent work. On some farms the ground is fall plowed instead of blank listed, on others two or three diskings take the place of blank listing, etc. Some land on which corn is planted is not worth $50 per acre; other land, however, is worth $150 per acre. But I believe these figures come as near representing the average cost of corn growing as the figures in the table represent the average acre value.

With this cost figured against the average acre value for the 1901-1913 period there is an apparent profit of $2.11 per acre when the corn is sold at market prices. To this profit must be added the value of the stalks for pasture or fodder or as silage. True, the farmer who would make the most money from his corn crop markets it through live stock, which, if intelligently done, will

give him a wider and maximum margin of profit. However, thousands of farmers grow corn for cash market only and realize thereon a very narrow margin of profit, and which fact again points to the advisability of growing the most certain feed crops and marketing these in the form of live stock products.



Kansas Map Showing Distribution of 1912 Kafir Acreage.—Each Solid Dot is 1,000 Acres and Each Open Dot 500 Acres or Less.—Total Acreage 1,422,114, With a Value of $19,635,557.—Figures from Kansas State Board of Agriculture.

It is not to be inferred that the labor cost of growing kafir and milo will be less than that of growing corn. However, there is in grain sorghum growing some variation from the figures given. Kafir and milo for maximum production and most certain yield require as good farming methods as does corn and the sorghum grower should regard that he has not discharged his duty as a farmer until he applies to grain sorghum growing the same intelligent effort and as much work as he would to corn.

Kafir. The total acreage, total value and acre value of kafir for each year of the period 1901-1913, inclusive, is here given:

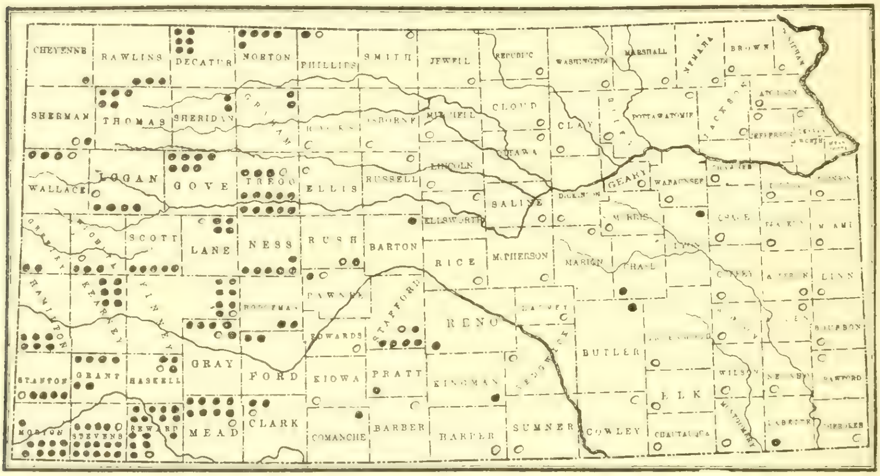
Year	Kafir Acreage	Total Value	Acre Value
1913.	1,403,731	$12,324,131	$ 8.78
1912.	1,422,114	19,635,557	13.81
1911.	919,046	14,455,037	15.73
1910.	619,808	8,011,283	12.92
1909.	636,201	7,150,080	11.24
1908.	630,096	6,856,845	10.88
1907.	508,485	5,658,859	11.12
1906.	548,497	5,039,238	9.19
1905.	538,393	5,352,810	9.94
1904.	518,372	5,041,546	9.73
1903.	660,097	6,142,179	9.30
1902.	748,176	9,495,572	12.69
1901.	618,816	6,388,025	10.32
	9,771,832	$111,551,162	
		Average acre value	$11.41
1893.	46,911	$450,903	$ 9.61

The figures indicate that the average acre value of kafir for the 1901-1913 period was $11.41, exceeding the average acre value of corn for the same period $2.65, or 30 per cent. Applying the same growing cost as for corn, kafir would show a profit of $4.76 per acre as compared with $2.11 for corn.

It will be observed by comparing the corn and kafir tables that in each year except three—1908, 1906 and 1905—the acre value of kafir exceeded the acre value of corn, also that in 1901, when corn was near a complete failure, kafir exceeded corn in value $7.11 per acre. Again in 1913, another year in which corn was near a complete failure, the value of kafir exceeded corn $6.77 per acre. It is to be observed that the poorer the corn year the wider the difference in acre value between the two crops, but in favor of kafir, and also that the better the corn year the higher the kafir value. This establishes the claim that in the poor year kafir does better than corn and in the good year is the near equal of corn.

This showing is outstanding and important when viewed from the standpoint of the live stock feeder.

The largest kafir acreage in the history of the state was grown in 1912, being an increase in excess of one-half million acres over the year previous. This increase followed the short corn year of 1911. Note the increased



Kansas Map Showing Distribution of 1912 Milo Acreage.—Each Solid Dot is 1,000 Acres and Each Open Dot 500 or Less.—Total Acreage 183,611, with a value of $2,300,402.—Figures from Kansas State Board of Agriculture.

acreage immediately following each poor corn year and the gradually decreasing acreage as the seasons continued favorable for corn and the "off" year was forgotten. In 1911 many silos were built and most of these were filled with kafir; this silage proving satisfactory, induced many stockmen to plant kafir for silage the following year. However, 1912 was the best corn year in the thirteen-year period and the kafir acreage was slightly reduced, showing the tendency to follow the success of the favorable year and forget that there ever was such a thing as a dry year.

The fact that the kafir acreage has in twenty years increased thirty times is significant, too, when it is considered that a deep-seated prejudice has existed against the crop. The present acreage is such as has forced it-

self upon the farmer—his attitude, as a matter of fact, having compelled it to grow and yield under methods of planting and cultivation much less favorable than those under which corn is grown.

Milo. The total acreage, total value and acre value of the Kansas milo crop for each year of the period 1901-1913, inclusive, is shown by the following:

Year	Milo Acreage	Total Value	Acre Value
1913.	229,534	$1,189,643	$ 5.18
1912.	183,611	2,300,402	12.53
1911.	174,404	1,808,855	10.37
1910.	100,700	1,033,239	10.26
1909.	102,492	959,258	9.35
1908.	55,255	515,269	9.32
1907.	22,090	234,686	10.62
1906.	17,563	146,289	8.32
1905.	20,550	190,974	9.29
1904.	7,166	73,476	10.25
1903.	6,889	60,851	8.83
1902.	5,839	56,166	9.61
1901.	5,988	45,063	7.52
	932,081	$8,614,171	
		Average acre value	$ 9.24
1893.	14,004	$ 121,331	$ 8.66

For the thirteen-year period the average acre value of milo exceeded the state's average for corn, forty-eight cents per acre or five per cent, and in only five of the thirteen years has the corn acre value exceeded that of milo. But it must be recalled that milo production is confined almost wholly to the western third of the state and the milo showing above is the record of that crop in a section for which corn is near an impossible profitable crop.

In 1913 the milo acreage was the largest in the state's history, being 229,534 or an increase of approximately 46,000 acres as compared with the year preceding. In

thirteen years the milo acreage has increased from 6,000 to about 230,000 which tends to show its general introduction into and dependence thereupon in that part of the state to which it has been adapted.

Considering milo for the thirteen-year period, its acre value is $2.17 less than that of kafir, and this is accounted for through the fact that the acre yield of both grain and forage is less than in the case of kafir, and the forage of milo has a lower feeding value than that of kafir.

Combined Kafir and Milo. The kafir and milo figures above are given separately that the reader may make such comparison of the two crops as the figures permit and that each may be compared with corn. However, in comparing the grain sorghums of Kansas with the corn of the state, the kafir and milo figures, as follows, may well be considered together:

1901-1913	Acreage	Total Value	Acre Value
Kafir.	9,771,832	$111,551,162	$11.41
Milo.	932,081	8,614,171	9.24
Totals and Av. . .	10,703,913	$120,165,333	$11.23
Corn.	91,635,224	$803,292,750	$ 8.76

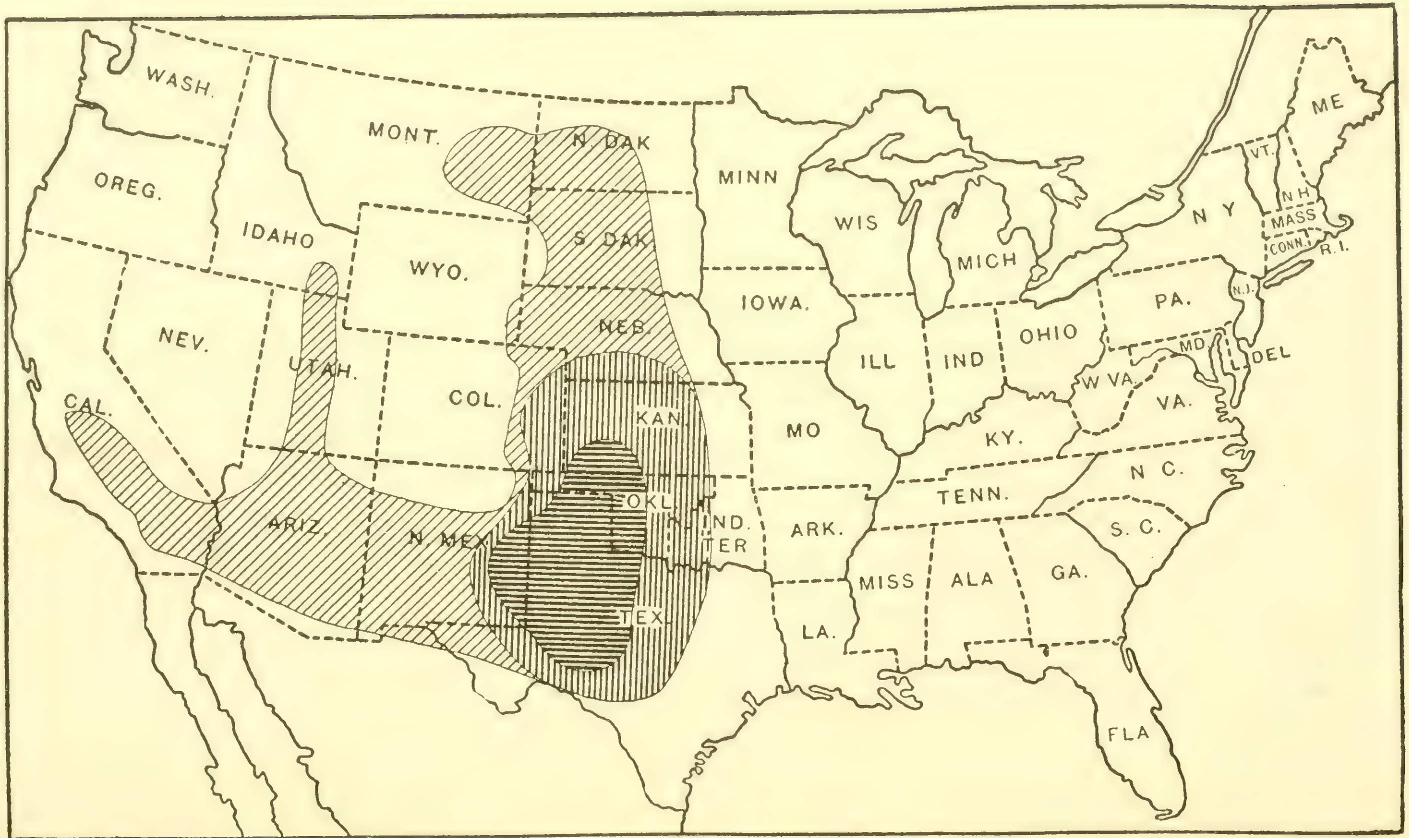
The difference between acre value of corn and the combined acre value of kafir and milo, is $2.47 or 28 per cent in favor of kafir and milo.

The figures show that in the thirteen-year period the farmers of Kansas planted one acre of kafir and milo to each nine of corn. Few farmers who have observed the comparative performance of these crops will approve such a small grain sorghum acreage—in the light of the surest and necessary feed supply.

Sorghums and Live Stock Population. The acreage of dry weather-resisting grain and forage crops grown and the number of animals reported on the farms of Kansas affords an interesting comparison. In 1912 the total cattle, horses, mules and sheep—these being the

forage-eating animals—within the state were 3,893,263, and the sorghum acreage for that year was 2,318,779, including 713,000 acres of cane—the latter not being heretofore included in the totals. The proper calculation reveals six-tenths acre of sorghum roughage provided for each animal in that year. Of course there were other roughages, hays and grains available for feeding, but none of these is so certain of yield or productive in acre tonnage as sorghums. The 1912 sorghum acreage being the largest in the state's history and the live stock population about normal, it would appear, without going into those figures necessary to show the acreage required to maintain an animal, that a far insufficient acreage of "sure feed crops" is being grown to properly feed the live stock in a year of short forage crops. It is apparent that if live stock is to be kept at the greatest profit it must be well fed, and since feed will return the grower a greater acre value when marketed through live stock, the growing and feeding of more grain and roughage cannot help but increase the farm revenue. It is elsewhere recorded that live stock farming gives from 18 to 48 per cent more profit than grain farming in the states of Illinois, Missouri and Iowa, and which states are favorable to the growing of market crops. It would seem that live stock farming in Kansas, as compared with grain farming, would appear still more profitable. But, live stock farming cannot be successful without an assured and abundant feed supply.

Kafir, Milo and Corn Compared by Sections. The more restricted the sections for which averages are made to apply, the greater the value of the averages. For example, the intending purchaser of a farm in the western third of Kansas would gain a better idea of what he could expect in crop yields if he knew the average yields for that third of the state than if he knew only the averages for the state as a whole. To permit a comparison of kafir and milo growing, with corn, for the western half and western third of Kansas, and that these may



In the Dark Shaded Area Milo is Now a Staple Crop; in the Next Lightest Shaded Area Milo is Now Adapted, and in the Lightest Shaded Area Its Adaptability is Being Tested.—From Farmers' Bulletin 322 by Federal Department of Agriculture in 1908.

be compared with the eastern half of the state and with the entire state, I have compiled the table below. The figures for the western half of the state are for those 54 counties lying west of a line drawn between Jewell and Republic counties on the north and Harper and Sumner counties on the south, and which line is approximately the 98th meridian. These counties comprise almost exactly the western half of Kansas. The figures for the western third of Kansas are for those 31 counties lying west of the Norton-Phillips county line on the north and the Clark-Comanche county line on the south. The western half, and of course the western third of Kansas, is within the sorghum belt as described by the Federal Department of Agriculture, and it is logical that a table permitting a comparison of grain sorghum and corn growing in Kansas' sorghum belt with that part outside of the sorghum belt, be given. However, the figures already given establish the claim made in the first few pages that in actual farm practice the whole of Kansas is included within the sorghum belt area.

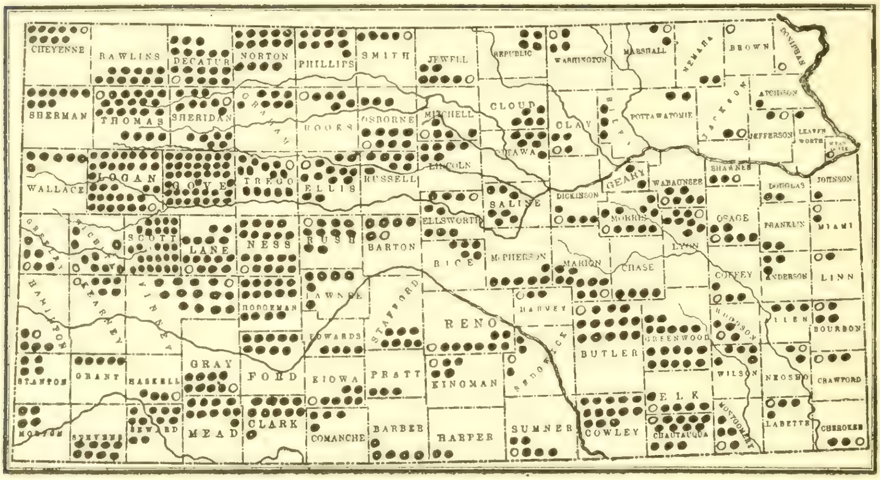
1901-1913	Kafir and Milo Acreage	Acre Value	Corn Acreage	Acre Value
State........	10,703,913	$11.23	91,635,224	$8.76
East half	5,139,566	12.39	60,497,155	9.57
West half ...	5,564,347	10.14	31,138,069	7.20
West third ..	2,786,103	9.24	9,106,819	4.73

It will be surprising, or was to me, that the acre value of kafir and milo for the western half of Kansas was only $1.09 lower than the average for the entire state, also that the acre value of corn for the western half was only $1.56 less than the acre value for the state. Whatever may be the real cause for the small differences, the figures should, nevertheless, be encouraging to the western farmer.

To me it was equally surprising that the acre value of kafir and milo for the western half of Kansas is only $2.25 lower than the value for the eastern half, and that

the acre value of corn for the western half is only $2.37 less than the acre value for the eastern half.

It would seem that the seasonal and soil conditions of the eastern half of Kansas, compared with those of the western half, should result in a greater difference in acre value of these crops for those sections.



Kansas May Showing Distribution of 1912 Cane Acreage.—Each Solid Dot is 1,000 Acres and Each Open Dot 500 or Less.—Total Acreage 713,000, With a Value of $7,049,986.—Figures from Kansas State Board of Agriculture.

It should be noted that the acre value of kafir and milo for the western third is only 22 cents less than double the acre corn value. The regrettable thing is that for the thirteen-year period in these thirty-one western counties there was planted only two and three-quarters acres of milo and kafir to nine acres of corn—a planting ratio which is not at all consistent with the returns of the two crops. It is worth while that every farmer in the western third of Kansas ponder this fact. Through so doing he should be able to see at least one way out. It will appear that for years through corn growing he has been in a great measure fooling away his time, wearing out himself and his family and enduring unnecessary disappointment.

In working up the data of these thirty-one western counties, to arrive at the averages, I was appalled to note the frequency with which total corn failures are recorded in several counties, marking the loss of the farmers' total season's labor and investment in the crop. But in such years in those same counties kafir and milo yielded both grain and forage in profitable quantities. If the whole acreage had been planted to these, much more stock could have been kept and enough beef, pork and cream sold to have made the farmer permanent and reasonably prosperous.

In the detailed statement I find counties of these thirty-one in which in the thirteen-year period kafir and milo have exceeded an acre value of $10 as compared with $4 to $4.50 per acre for corn, yet these counties have planted within that time more than a million acres to corn and slightly less than one hundred thousand to grain sorghums. Other inconsistencies equally astounding could be pointed out, but respect for those who have long endured the inevitable hardships of a new country forestalls further and unnecessary analysis. I only hope to see the day when the western farmer will be convinced —somehow by somebody—that he has too long been seeking the "pot of gold at the end of the rainbow," and will turn his hand to those things which promise well and through which possible, but improbable failure, can be no greater than those failures of the past.

Ten Kansas Counties Grow More Sorghums than Corn. There are ten Kansas counties growing a larger acreage of kafir and milo than corn, and these deserve special mention. These counties form almost a square in the southwest corner of the state. Here the grain sorghum acreage has been steadily and consistently increasing for years. The corn acreage has also increased, but has held about the same relation to the grain sorghum acreage throughout the period as at the beginning. In no year during the thirteen has the corn acreage

exceeded the kafir and milo acreage. The following table reveals the record of grain sorghum growing as compared with corn for the several counties for the 1901-1913 period, inclusive:

County—	Kafir and Milo Acreage	Acre Value	Corn Acreage	Acre Value
Finney	109,425	$11.22	62,504	$ 7.74
Grant	62,113	7.83	13,475	5.27
Hamilton	71,825	8.63	13,609	6.24
Haskell	59,341	8.28	22,521	5.51
Kearney	68,254	10.32	26,676	8.19
Meade	203,444	10.20	100,219	5.85
Morton	59,198	9.53	11,352	6.54
Seward	173,325	9.70	65,858	6.16
Stanton	52,410	8.31	9,859	5.53
Stevens	166,848	10.20	44,171	5.83
	1,026,183		370,244	
Total value		$9,992,634.00		$2,362,762.00
Av. acre value..		9.73		6.38

It will be seen that during the period two and three-fourths acres of kafir and milo were planted to each acre of corn, and the average acre value of these sorghums was 52.5 per cent in excess of the acre value of corn. In none of these ten counties did the average acre value of corn exceed that of kafir and milo, for the period. The milo acreage in 1912 was about 15,000 greater than that of kafir, and during the period the milo acreage has each year been increased.

It will be a matter of some interest that for these ten extreme southwestern counties the acre value of kafir and milo should be only $1.50 below the average for the state, and the acre value for corn only $2.38 below the state average.

It is worthy of note, too, that the acre value of kafir and milo for these ten counties is 49 cents in excess of the average for the western third of the state and that

their acre corn value is $1.65 above the average for the same section. This comparison would seem to indicate that the twenty-one counties lying north of the ten were equally good producers of grain sorghums, but not of corn. Yet, in these twenty-one counties—as shown by the acreages of kafir and milo as compared with corn—the farmers are reversing the present practice of their neighbors in the ten southern counties. It would seem that the counties directly north and extending to the state line, could well afford to give more attention to the general use of the grain sorghums, and milo in particular, since that sorghum will mature grain throughout the western third of Kansas.

Butler Big Sorghum-Growing County. The most conspicuous sorghum-growing county of Kansas is Butler, and in which county is grown one-fifteenth of the state's total kafir and milo acreage.

Year	Kafir and Milo Acreage	Acre Value	Corn Acreage	Acre Value
1913	99,505	$11.99	92,265	$ 1.54
1912	119,838	14.00	84,417	12.65
1911	78,370	15.01	115,831	10.62
1910	58,848	13.00	139,924	6.60
1909	49,834	10.50	148,250	11.20
1908	44,233	9.00	143,891	13.25
1907	34,725	12.25	148,902	9.45
1906	38,390	7.50	134,525	10.44
1905	31,231	10.00	148,536	9.10
1904	27,891	9.00	133,067	8.00
1903	31,257	8.00	138,684	7.00
1902	35,792	12.00	135,792	13.20
1901	26,332	12.00	156,014	2.88
	676,246		1,720,098	
Av. acre values		$11.84		$8.93
1893	852	10.74	132,943	3.60

The above is a tabulated history of kafir, milo and corn growing in Butler County for the years 1901-1913, inclusive. Through its large acreage of grain sorghums, principally kafir, and its annual kafir carnival held at El Dorado, Butler County has gained prominence at home and abroad.

It will be seen that Butler County grows one acre of grain sorghums to each two and one-half acres of corn. There is not another county located within the eastern half of the state which grows so large a proportion of grain sorghums to corn.

For the thirteen-year period the acre value of kafir and milo in Butler County exceeded that of corn 32.6 per cent, and in only four of the thirteen years did the value of corn exceed that of the sorghums.

It should be noted that in 1893—the year in which the kafir and milo figures were first included in the report of the State Board of Agriculture—Butler reported only 852 acres of grain sorghums, and in the twenty years has increased that acreage to one hundred thousand. However, the 1912 acreage exceeded this figure almost twenty-thousand. In this same connection it is interesting to observe that in 1893 the county grew 132,943 acres of corn, with an acre value of $3.60, as compared with an acre value of $10.74 for kafir and milo for the same year. A point deserving special note is that the corn acreage during the period 1893-1900 showed an increase each year, but beginning with 1901 and continuing through 1913 has shown a steady decrease from 156,014 to 92,265 acres. On the other hand, it is to be noted that the grain sorghum acreage has increased, and of this acreage kafir is the principal crop, there having been planted only 500 acres of milo in the year 1913.

That Butler County is not essentially different in soil or seasonal conditions which would make kafir and milo better adapted to that county than to others in Eastern Kansas, is shown by the fact that its acre corn value for the thirteen-year period is practically the same as the

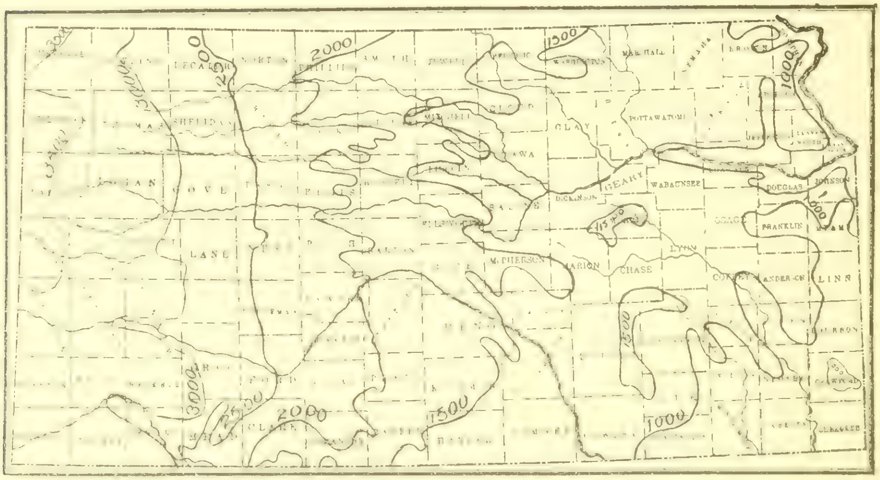
average for the eastern half of the state, being only sixty-four cents below that average, and its grain sorghum acre value only fifty-five cents lower than the average for the same section. This is some evidence that conditions in Butler County are not more conducive to the growing of kafir and milo, nor less conducive to corn growing, than those counties, generally, comprising the eastern half of the state. It would seem, therefore, that the supremacy of Butler as a grain sorghum-growing county, as compared with other Eastern Kansas counties, rests wholly upon its acreage planted rather than upon any increased yield of grain or forage as compared with other eastern counties.

Butler in 1912 had 104,886 cattle, sheep, horses and mules, and with this number led all other Kansas counties. Besides, in that year there were in the county 34,000 swine, this number being exceeded by only eight other counties in the state. In 1912 there was grown in the county 132,932 acres of sorghums, including 13,000 acres of cane, or 1.27 acres of sorghums, to each of the forage-eating animals. This acreage is striking as compared with six-tenths acre grown for each of the same kind of animals for the entire state. The total live stock population of Butler is quite out of proportion—in comparison with other counties in the eastern half of the state—to the amount of corn produced, indicating that its live stock is successfully maintained and to a greater extent, on the grain and forage of sorghums than is the case in any other important live stock county in Kansas.

The Lesson of Kafir and Milo. There are farmers in every locality who are securing corn, kafir and milo yields year after year, two or three and even more times in excess of the average for their communities. There are farmers who rarely experience even a near failure in sorghums or other feed crops and who always have feed sufficient to well winter their live stock and to feed their cows to a point of liberal milk production. With these farmers their success is not wholly one of rainfall

or otherwise favorable growing seasons. Such examples are worthy of imitation and hold encouragement for every other farmer.

Kansas has attained distinction as the largest grain sorghum producing state, because her conditions of soil and climate are such as have compelled her farmers to place dependence in the sorghums, and not because they



Map of Kansas Showing Altitude of the Several Sections of the State.

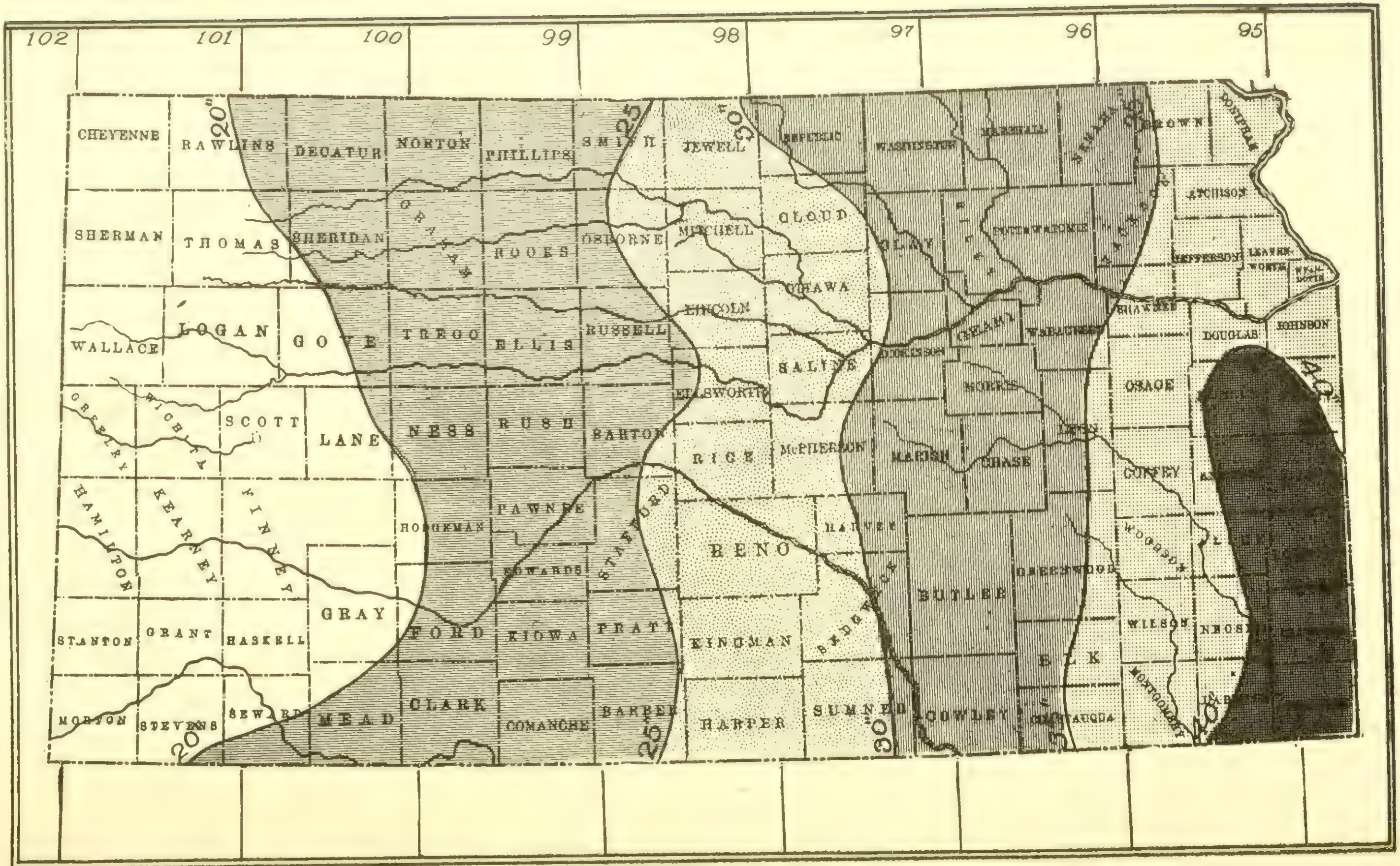
would follow grain sorghum growing as a more profitable crop than others they have for years grown. In other words, to date Kansas is growing grain sorghums only to the extent that they are absolutely needed and not because the possibilities of grain sorghum growing have been realized to the extent that any big live stock or other attendant industry has been established thereupon. The evidence given in this chapter would indicate that kafir and milo are enough surer feed and forage crops to justify an increased acreage and to warrant the feeding of more of all kinds of animals and the building up of a greater live stock industry within the state and an increased farming prosperity.

SORGHUM AREAS DEFINED.

Climates are not changed by man. As shown by the records for long periods, climates do not change from any cause. That rainfall does not follow the plow, must be accepted by every farmer as a fact. The great mass of data accumulated during the hundreds of years, is the evidence which controverts the theory that the rainfall increases as virgin areas come under cultivation. There have been no perceptible changes in climate or rainfall anywhere within historical time. Extended dry periods are not followed by extended wet periods, operating in cycles, as is claimed by many who depend upon their recollection instead of relying upon existing records. The fact is that the average precipitation for each ten-year period of the past has been about the same; dry years have alternated with wet years, and it will always be so. When the farmer settles in a new country he can depend upon the precipitation of that country continuing as shown by the records of the past and his farming operations should be governed thereby.

Climate Governs Farm Methods. Varying annual precipitation, distribution of rainfall through the growing season, length of growing season and moisture-dissipating forces, result in regions which are vastly different agriculturally. These make necessary a character of farming and crop varieties in Wisconsin greatly different from those of South Carolina. Even in Kansas—in the two hundred miles north and south and four hundred miles east and west—are variations in climate which make necessary several widely differing methods of soil handling and different varieties and combinations of farm crops.

Every thoughtful farmer will realize, upon a moment's



Map Showing Annual Precipitation for the Several Sections of Kansas.

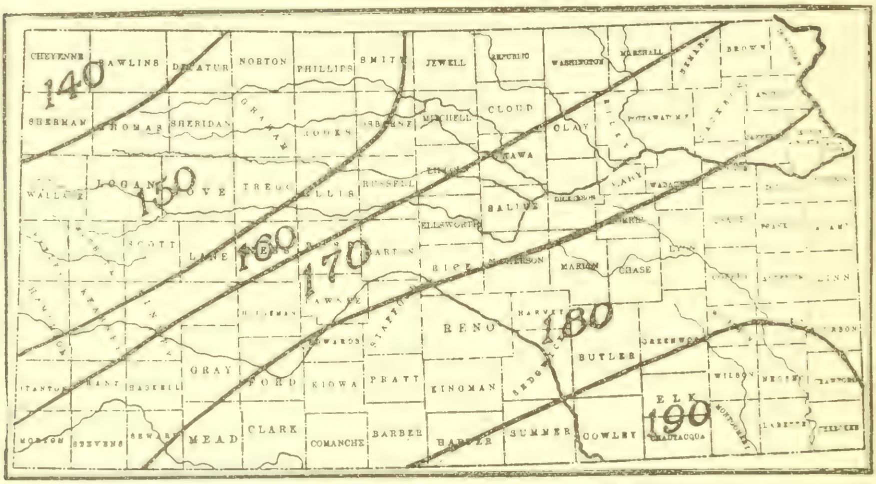
consideration, that the successful farmer in Western Kansas must necessarily follow different methods than those practiced in the eastern part of the state. That many Western farmers have failed in a great measure to recognize this, is evidenced by their many years of indifferent success through the same farming methods and the use of the same kind of crops as prevail "down East." The farmers of Western Kansas are not alone in their refusal to recognize the necessity of agricultural methods peculiar to their location. This same thing is true, generally, of farmers throughout the sorghum belt.

It is certain that farming cannot be most profitably done without due recognition of the prevailing climatic conditions. Those recommended methods which apply to the regions of lighter rainfall and which are designated as "dry farming," are directed toward moisture conservation throughout the year. The principles of such practice have been established as vitally important in the soil handling methods of sections having less than thirty inches of annual precipitation. Such sections require farm crops which make economical use of the soil moisture and which evade or resist the dry weather.

The usefulness of the sorghums varies with the conditions under which they are grown. Every grower in Eastern Kansas knows that kafir will, in a normal season in his section, produce more grain and forage than will milo. Northwest Kansas growers know that in their section in normal seasons milo is more certain of grain production than is kafir. This is so, not only because of the varying seasonal conditions, but because of the varying inherent characteristics of the two plants. Recognizing a section better adapted to milo than to kafir, is to acknowledge the differences in climate—particularly the length of growing season and annual precipitation—and such admission calls for different preparation, planting and cultivation methods.

The map showing the mean annual rainfall of the United States, on page 6, should be observed in connec-

tion with the above. From this map it will be seen how the areas of varying rainfall extend north and south across the middle section of the United States, and how Texas, Oklahoma, Kansas, Colorado, and states north of these have the same rainfall divisions. The only essential differences between farming in the belt of thirty inches of rainfall in Texas and in Kansas, is that of soil



Map Showing Average Number of Days in Growing Season for Several Sections of Kansas.

and length of growing season. The farmer in Texas and the farmer in Kansas in the same rainfall division, have the same problem—that of making the most effective use of soil moisture.

Elsewhere, briefly, has been described the general character of climatic conditions as they prevail throughout the sorghum belt. It is my purpose in this chapter to enter into a somewhat detailed discussion of sorghum growing as applying particularly to Kansas, but which the reader can apply to Oklahoma, Colorado, Texas, or other sections, if he will ascertain the length of growing season as determined by the average dates of killing frosts in the spring and fall, the annual precipitation, the months in which the rains fall and the amount of rainfall. If he will apply the conclusions from such find-

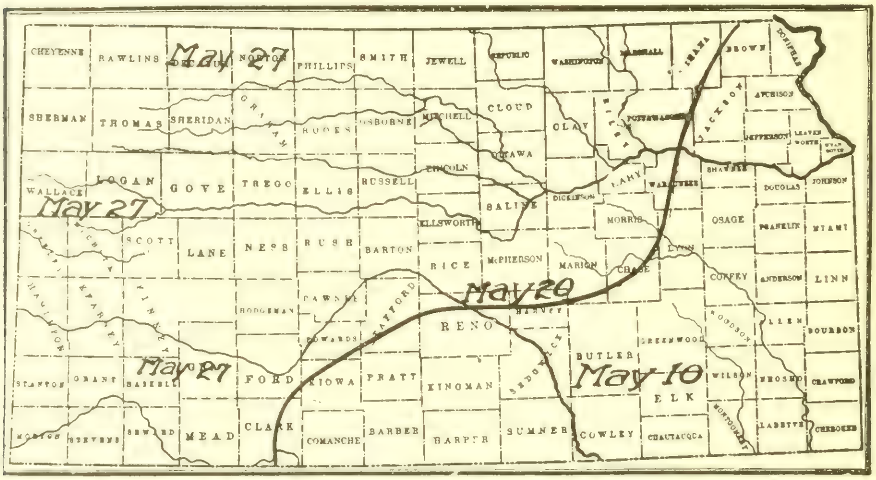
ings to his crop growing methods, he will be a more successful grower of grain and feed crops than his neighbors who fail to recognize the controlling influences.

Growing Season in Sorghum Belt. In the growing of sorghums the length of the growing season is a matter of concern only to the farmer located in that part of the sorghum belt of which Western Kansas and Eastern Colorado are a part. At the extreme north end of the Texas Panhandle the season is 190 days, and of course longer farther south. In the Panhandle of Oklahoma it is 170 to 180 days, and gradually decreases to 140 days in Northwestern Kansas. In Eastern Colorado the growing season ranges from 160 days on the South to 130 days on the North. So, south of the Kansas-Oklahoma line the season is plenty long for corn, kafir and milo, and even cotton. But north of that line and west of the 98th meridian in Kansas and Colorado the diminishing length of the growing period is a matter of concern and such as necessitates early maturing varieties of all spring planted crops. The several frost date maps and that showing the length of growing season, each for Kansas, can be made to apply to Eastern Colorado if the reader will extend the lines in the same general trend across that state.

Kansas' Precipitation and Altitude. I am confident that by reference to the precipitation map of Kansas, the reader will be surprised to note the gradual and rapidly diminishing precipitation from the eastern line of the state to the western line. The two eastern tiers of counties have thirty-five to forty inches, whereas the western tier of counties has less than twenty inches of precipitation annually. The eastern third of the state has thirty to forty inches, the central third twenty-five to thirty inches, and the western third twenty-five inches in a small part of the east side and decreasing to less than twenty inches in the western tier of counties.

Another map indicates the gradually increasing altitude from less than 1,000 feet on the east line of the

state to more than 3,500 feet on the west line. It is interesting to note that the line describing that section of the state having an altitude below 1,000 feet has forty inches of annual precipitation. The line of 1,500 feet altitude generally marks the western limit of an area having twenty-five inches of precipitation. The line of 3,000 feet altitude closely approximates the eastern limit of twenty inches of precipitation.



Map Showing Latest Dates on Which a Killing Frost Has Occurred in the Spring in Kansas.

Kansas Frost Dates. Those maps showing the date of latest recorded killing frost in the spring and the average date of last killing frost in the spring, and those showing earliest killing frost in the fall and the average date of fall killing frost, also that showing the average days in growing season for the several sections of the state, studied with the maps of precipitation and altitude, will reveal many things of value to the crop-growing farmer. The climatology of Kansas is revealed in these maps and at a glance the reader will catch those things which would require many pages to describe. The maps illustrate the reasons for many statements herein made. They offer indisputable evidence that the same farming methods and the same kinds and varieties of crops will

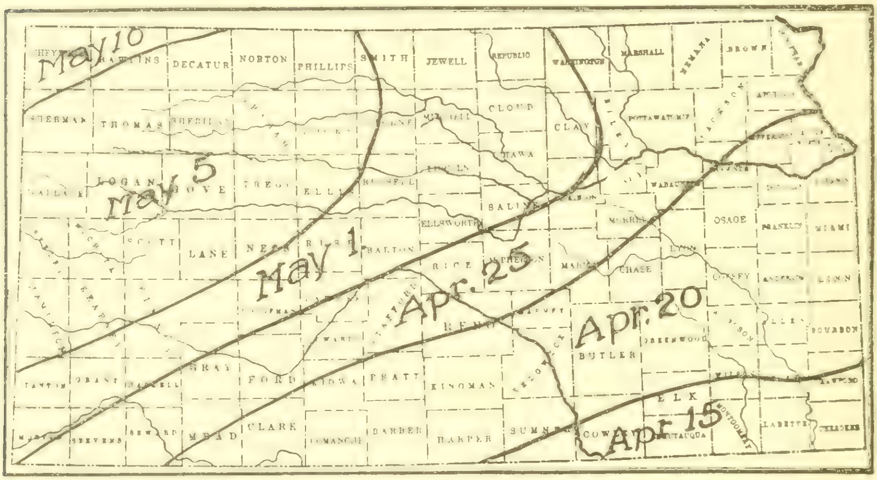
not succeed throughout Kansas or other states where similar conditions exist. To me, these maps tell the whole story of the necessity for a revision of farming methods in a large portion of Kansas. They unquestionably establish a wide variation in unchangeable agricultural conditions and offer insurmountable evidence that the farmer must adapt thereto his entire range of farming.

Precipitation and Sorghum Areas. For many years it was held that kafir would produce grain in profitable quantities only in areas of twenty-five inches or more of annual precipitation, and that milo was the profitable grain sorghum for areas of less than twenty-five inches. These were well fixed ideas in the minds of Central Kansas farmers twenty years ago. The origin of these beliefs, I do not know. However, the kafir of those days yielded more grain and was more certain of profitable production with twenty-five inches of annual precipitation than the kafir Kansas has been growing the past ten years. It is my opinion that the kafir of that time was better adapted to areas of less than twenty-five inches of precipitation than is the kafir now commonly grown in Kansas. Why I think so will be told later.

An interesting view in this connection is that of H. M. Cottrell, agricultural commissioner of the Rock Island Lines. After years of careful inquiry into the performance of these several grain sorghums and after having observed the performance of feterita during the past two or three years, he holds that kafir should be grown in those areas of Kansas and Oklahoma having twenty-four inches or more of precipitation, milo in areas having sixteen to twenty-four, and that feterita deserves a thorough trial in sections having less than sixteen inches.

It is important to note to what extent the farmer has determined the kafir and milo-growing sections for Kansas and in connection therewith to observe those conditions which point to the desirability of sorghum growing. In almost every locality there are progressive farmers

who have established the most successful crop and farm methods for their section. The accomplishments of these men and the work and observations of the agricultural experiment stations, provide the safest guide for recommendation of general practices. I believe it safe to say that those farmers who have pioneered in sorghum growing have proven the adapted areas and the relative merits of the grain sorghums for the several sections of Kansas. The distribution of the sorghums throughout Kansas is illustrated by the several maps.



Map Showing Average Date of Last Killing Frost in the Spring in Kansas.

Kafir Distribution in Kansas. By reference to the map on page 100, it will be seen that more than half of the kafir acreage of Kansas is grown in the eastern half of the state. This area has an annual precipitation of thirty inches on the west border, increasing to forty inches on the east, and the growing season ranges from 160 to 190 days. In Eastern Oklahoma under a corresponding precipitation but longer growing season, kafir has become an established farm crop. The performance of kafir compared with corn, as presented in the preceding chapter, indicates, beyond doubt, that farmers have found

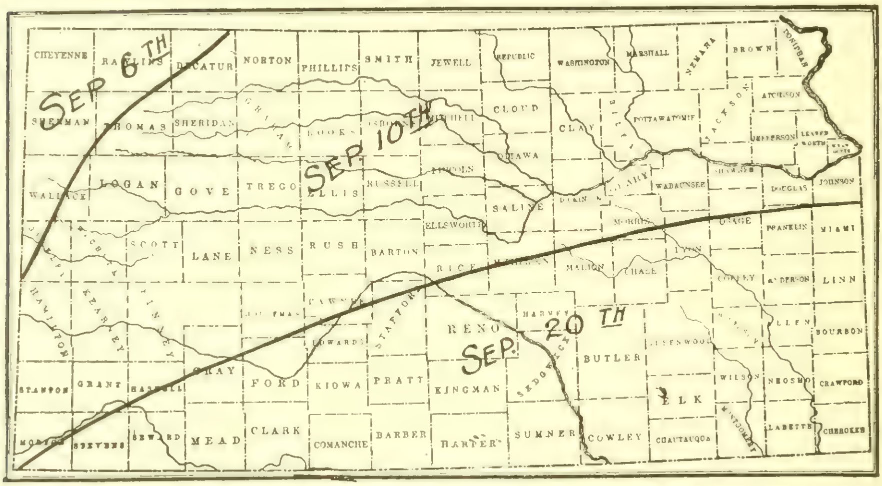
the common varieties of kafir most useful in sections having thirty inches or more of annual precipitation. Also, as shown by the map, kafir is more generally grown than any other sorghum crop in the eastern two-thirds of the state and west to the area of twenty inches of annual precipitation and 150 days of growing season. It may therefore be said that the eastern two-thirds of Kansas, with precipitation ranging from twenty-five to forty inches, is the kafir area of Kansas. Under twenty to twenty-five inches of precipitation common kafir is not doing as well as the need demands. Dwarf kafir, now being developed, promises to supply the need for this area.

It is deserving of note that the south half of the state grows a larger acreage of all kinds of sorghums than the north half. This is because of the longer growing season in the south half and the failure of farmers in the north half of the state to develop sorghums of early maturity and keep them so.

Milo in Western Third of Kansas. The map on page 102 shows the distribution of milo throughout Kansas. It reveals a small acreage grown in the eastern two-thirds of the state, although for at least twenty-five years more or less milo has been grown in each county of the eastern two-thirds. During this time it has not proven a sufficiently close competitor of kafir to warrant its adoption as a farm crop. The map, however, shows that in 1912 every county in Kansas grew 1,000 acres or less. The largest milo acreage is in the western one-third of Kansas, which has a precipitation of twenty inches or less and a growing season of 160 to 140 days. Each successive year is resulting in its more general planting, because farmers have found it more certain than kafir as a grain crop. The earlier maturity of milo, as compared with common kafir, and its more economical use of moisture, are characteristics which make it better adapted than kafir to western needs.

The milos are being improved and their usefulness

increased and as acclimated home-grown seed is available the western third of Kansas will increase its milo acreage. The Oklahoma and Texas milo-growing sections are those of twenty inches or less of precipitation. So it would seem that farm practice had designated milo as the grain feed crop for such areas. The forage of milo is not regarded in Western Kansas as a desirable rough-



Map Showing Earliest Date of Killing Frost in the Fall in Kansas.

age, but in Colorado and Texas milo-growing farmers feed it with good results to all kinds of live stock. However, the farmers of the milo-growing sections are fortunate in being able to grow cane for forage, the latter being the acknowledged sure forage crop under such conditions as enforce the use of milo for grain.

Milo in Thomas County. In the year 1913 milo matured in every county in the western third of Kansas, except in those few counties in which grasshoppers destroyed all growing crops. P. S. Houston, of Thomas County, wrote Kansas Farmer his experience with two hundred acres of milo in 1913, and a portion of his letter is here printed. It shows the early maturity of the crop, the satisfactory results of thin planting and the apparent increased crop assurance through planting on land

which had not the year before grown a crop but which was free from vegetation—a condition near approaching summer fallow. He writes:

"I planted 200 acres of milo. I began planting May 15 and finished about June 10. The early planting gave the highest yield, there being a larger percentage of the heads well matured than in the case of the later planting.

"My experience is that milo should be planted by the middle of May and not later than May 20 for the best results in this section. I planted with a lister, using one bushel of seed to twelve to fourteen acres, which placed the stalks from eighteen to twenty inches apart. On account of this land being clean, the crop was cultivated only once. On stubble or foul land one cultivation would not be sufficient.

"The crop matured in about ninety days. I think with more moisture the milo would have matured sooner. I cannot say just what our rainfall was during the growing season, but it is certain that it was far below normal. The entire field yielded about twenty-five bushels per acre.

"I planted 320 acres of corn on the same kind of ground and under the same conditions except that it was planted earlier than the milo, which gave it an advantage, and it made from nothing to five bushels per acre. This proves to me that milo is a far better crop than corn for Western Kansas.

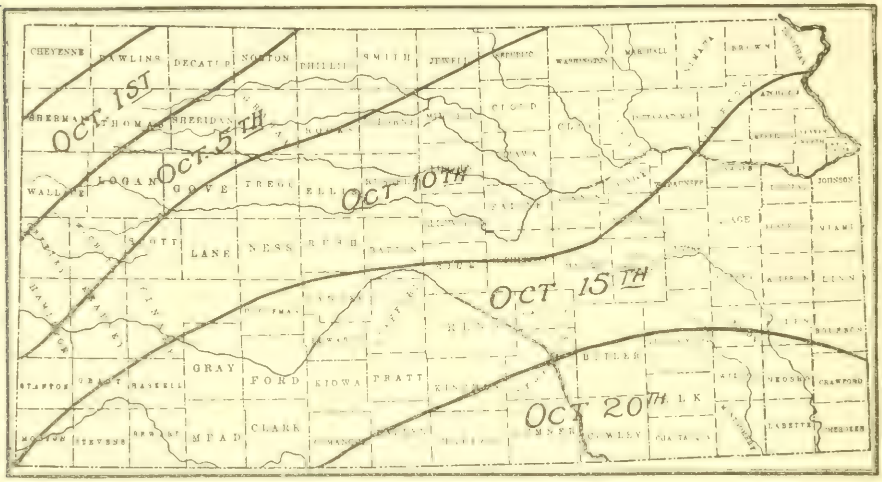
"I think it very necessary to plant acclimated seed. This conclusion is drawn from my own experience. The seed I planted was home-grown. I find that fields in the same vicinity planted with seed from the East or South have not done so well—in fact little of it matured last year.

"I am satisfied, too, that milo is a better dry weather crop than kafir. We had a field of kafir planted under the same conditions as the milo, and while there was not to exceed five per cent of the kafir that headed at all, at least ninety per cent of the milo matured well and pro-

duced most excellent seed.

"I planted both standard and dwarf milo, but could see little, if any, difference. I would urge that Western Kansas farmers plant more milo and less corn and small grain.

"I have had no experience with feterita, but from observations made I prefer the milo."



Map Showing Average Date of First Killing Frost in the Fall in Kansas.

Cane Distribution for Kansas. The distribution of cane acreage throughout Kansas is shown by the map on page 108. A glance reveals that the counties in the western third of Kansas, in proportion to the land planted to feed crops, grow more cane than the counties farther east. In these counties cane produces more forage than either kafir or milo and the forage is a better feed than that of milo. Still, much kafir is grown for forage in the same counties, but it is planted with the hope that it will make grain as well as forage—a thing it will do in favorable seasons. It is maintained that cane will do better on thin lands than will kafir or milo, and this is another reason for its more general use in the West than in the East, although it is well known that on the more fertile soils and in areas of greater precipitation the acre

tonnage is proportionately increased. Cane as a dry weather forage plant is superior to all other sorghums and this seems established by the larger acreage grown under twenty inches and less of precipitation. Through the use of the silo the farmers of Northwest Kansas will make a better use of cane and it will return them a larger profit than heretofore.

The cane acreage in the central and eastern thirds of Kansas has not been as large during the last ten years as formerly. This, principally, because of the planting of kafir as a combined forage and grain crop. Even when only a forage crop is desired, on most farms kafir has preference over cane in the eastern two-thirds of Kansas. This, because the roughage of kafir is generally regarded as superior to cane in feeding quality, the kafir forage keeping better than that of cane. However, cane will usually produce a greater tonnage of forage per acre than will kafir. As the silo comes into more general use and the largest acre yield of silage is desired, it is our opinion that Eastern Kansas will increase its cane acreage. Yields of twenty tons of green forage per acre have been grown for silage in Central Kansas, and as much as thirty tons per acre are reported from eastern counties.

Cottrell Locates the Sorghums. Here are H. M. Cottrell's ideas relative to the location of kafir, milo and corn in Oklahoma and Kansas:

"Every farm in Eastern Kansas and Eastern Oklahoma should grow some kafir. On the river bottoms, at least one-fourth of the acreage on each farm that is usually planted to corn should be planted to kafir. On the uplands kafir will outyield corn every year, in both bushels and feed value.

"In Central Kansas and Central Oklahoma, all upland usually planted to corn should be planted to kafir. It will produce a good yield of grain every year and in average years a large yield. On the uplands kafir will produce from 50 to 100 per cent more feed value than corn. A small acreage on every bottom farm should be

planted to kafir each year, to guarantee feed for the teams and other live stock in dry years.

"In Western Kansas, Western Oklahoma and the Panhandle, all land used for producing grain feed should be planted either to kafir or to milo, depending on the spring moisture conditions and average rainfall."

Encourage Kafir and Milo Growing. "The growing of crops that have proven resistant to unfavorable

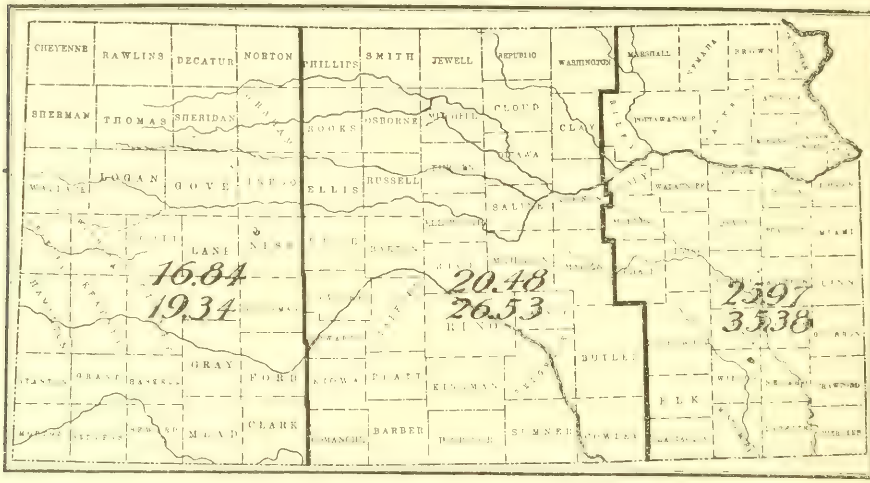


Fig A—Map Showing Annual Precipitation of Each Third of Kansas. The Upper Figure Shows Inches of Rainfall, April to September, Inclusive.—By S. D. Flora, U. S. Weather Bureau, Topeka.

conditions should be encouraged. These crops are kafir, milo, and other sorghums," writes E. H. Webster, formerly director of the Kansas Agricultural Experiment Station. "It has been demonstrated that even in years like last year—1911—there need be no shortage of feed. Kafir and cane will supply grain and forage and they are most excellent silage crops. The silo which is no longer an experiment but a tested and proven institution in this region, is opening new fields of opportunity for the stockman."

"The Precipitation That Kansas Receives." Under this title, S. D. Flora, of the U. S. Weather Bureau,

Topeka, prepared for this book the following brief but comprehensive statement illustrated by the three accompanying maps. The article will add much to what has heretofore been written regarding the climate of Kansas:

"The amount of precipitation—rain, melted snow and sleet—received during the year in any county of Kansas is the most important thing about the climate of that county. It determines almost altogether the kind of crops that will be grown, the density of population and the price of real estate, and, unfortunately, is the one thing about which there seems to be the most misunderstanding in other parts of the country.

"It is interesting to note in connection with stories of 'Drouthy Kansas' that, as shown by the accompanying map, Fig. A, the eastern third of Kansas receives an average precipitation of 25.97 inches during the six crop-growing months of the year, April to September, inclusive, which is greater than the average precipitation of any other state for these months, with the exception of a few Gulf and South Atlantic states.

"The average annual precipitation of Kansas, as shown in detail by the accompanying map, Fig. B, ranges from over 44 inches in the southeastern corner to just a little more than 15 inches at the Colorado line.

"The annual average for the state as a whole is 27.85 inches. For the eastern third of the state it is 35.50 inches; for the middle third, 26.88 inches; and for the western third, 19.35 inches. This decrease in the annual precipitation from the eastern to the western line of the state takes place with remarkable uniformity.

"Dividing the state with an east and west line we find the average for the northern half is practically the same as the average for the southern half, and any county on the Nebraska line will receive substantially the same amount of precipitation as a county due south of it on the Oklahoma line, except that the southeastern quarter of the state shows a slight excess over the northeastern

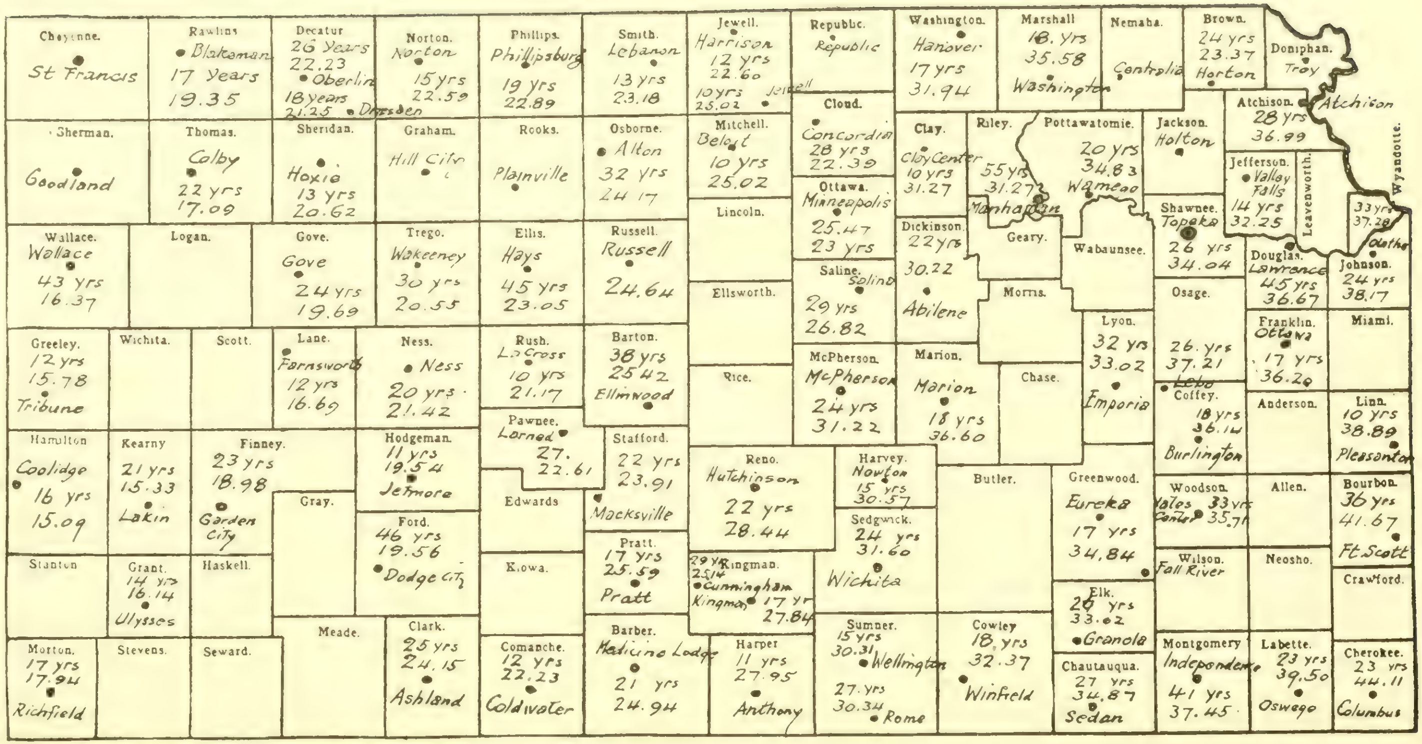


Fig B—Map Showing Annual Precipitation and Number Years of Record at Each Co-operating Station of the U. S. Weather Bureau in Kansas.—By S. D. FLORA, U. S. Weather Bureau, Topeka.

quarter and the northwestern quarter receives slightly more moisture than the southwestern quarter.

"Practically all the state, except the two western tiers of counties, receives more than 20 inches of precipitation annually.

"The annual precipitation for the eastern half of Kansas is about the same as the average for the states of Iowa, Michigan or Wisconsin, and but slightly less than that of the states of Illinois, Indiana and Ohio, and it falls at a more opportune time of the year than that of any of the states mentioned.

"From 70 per cent to 80 per cent of the entire year's precipitation falls in Kansas in the six crop-growing months, April to September, inclusive. In the states east of Kansas relatively less of the year's moisture falls in summer and more in winter. In the Pacific Coast states nearly all the precipitation falls in the winter months.

"Whether there has been any increase or decrease in the average annual precipitation in Kansas since white men first occupied it, is a question that has been the subject of much bitter controversy in some quarters and one that might make the future of the state very uncertain, were it not that, fortunately, accurate records of precipitation have been kept at numerous places in the state for periods ranging from 30 to 76 years.

"In order to get information on this subject that was more definite than the recollection of impressions of the 'oldest inhabitant,' all the precipitation records in the state that extend back any considerable number of years have been divided in the middle and the averages for the last half of each record have been compared with the averages for the first half.

"On the accompanying map, Fig. C, the portions of the state where the long records show a *decrease* in the average precipitation are white, and where they show an *increase* the map is shaded. The figures preceded by a minus sign show the average decrease in the

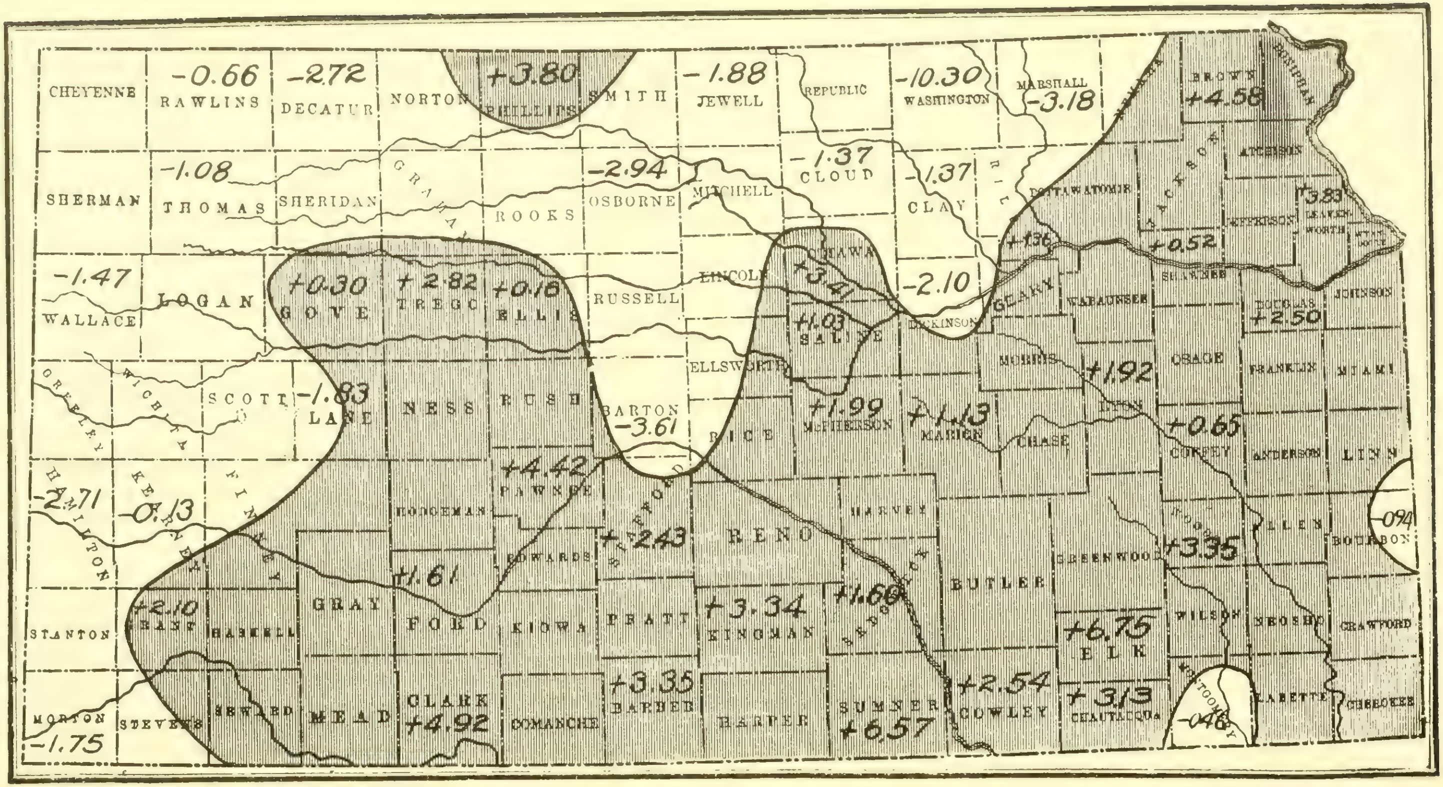


Fig C—The Dark Shaded Area Shows an Increase and the Unshaded a Decrease in the Annual Precipitation for Kansas During the Last Half of the U. S. Weather Bureau Record.—By S. D. FLORA, U. S. Weather Bureau, Topeka.

precipitation in the last half of the record, and the figures with a plus mark before them show the average increase in the last half.

"This map seems to show that there has been a decrease in the average precipitation in the north central and western portions of Kansas and an increase in the south central and the eastern portion. In either case the increase or decrease has been so small that no importance can be attached to it, and there is no reason that the next 30 years may not show a reversal of conditions.

"While it would certainly be more desirable to have all the records used on this map extend back to the same year, the final result seems to justify the method and demonstrate the futility of trying to prove any progressive change in the precipitation that has fallen in Kansas in the past 40 years.

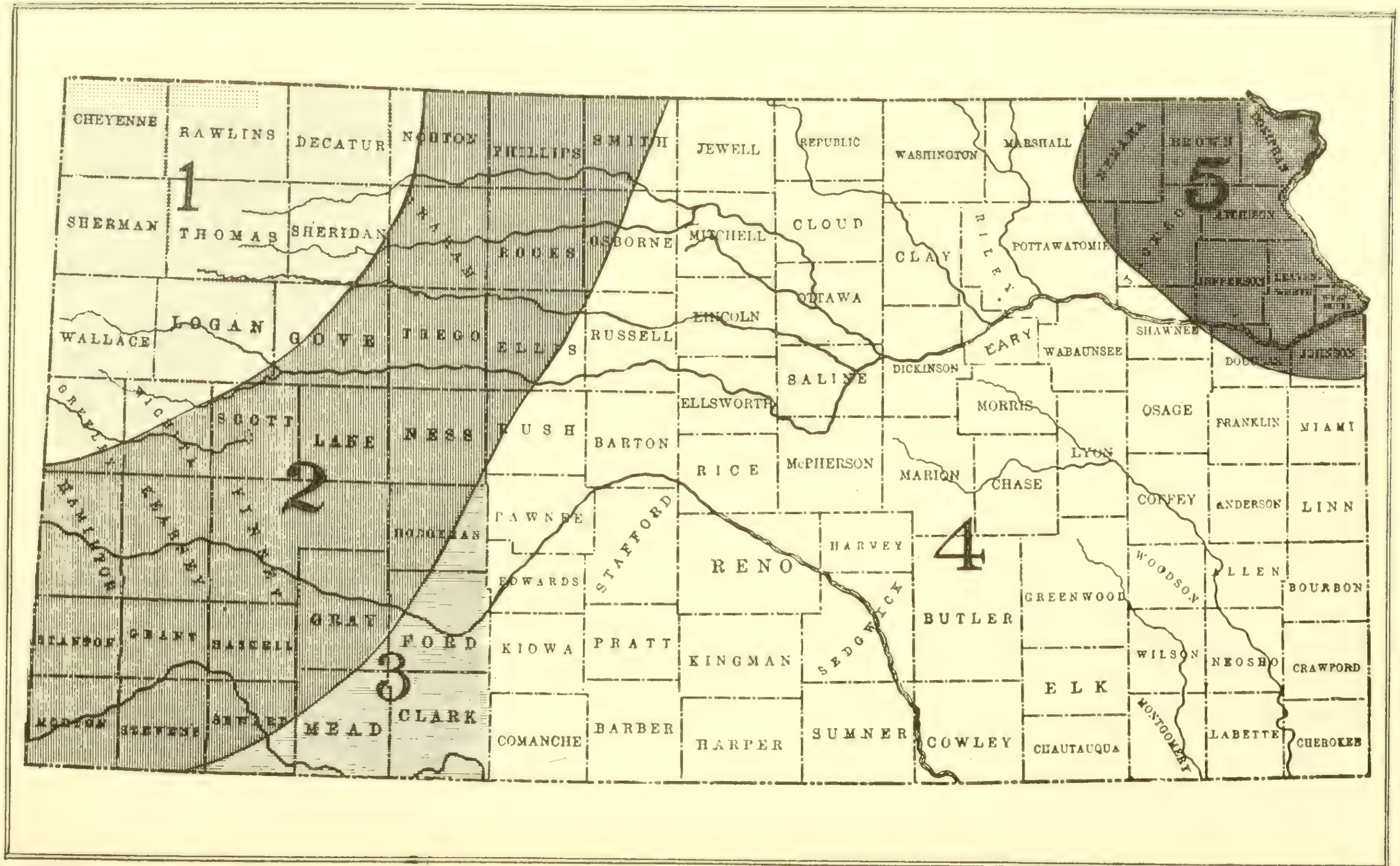
"It might also be said in this connection that it has not been possible to compile any reliable data showing that the rainfall in Kansas is any differently distributed through the year than it was 40 years ago, or that there has been any change in the prevalency of drouths."

Eastern Kansas Kafir Experience. Eastern Kansas corn growers should carefully consider this experience reported by J. G. Mitchell, Wilson County, and whose farm is in the area of thirty-five to forty inches of annual precipitation:

"I suggest that you farm paper editors push kafir more than you do. I am certain that it should be the standard crop instead of being considered a make-shift or catch crop for dry years.

"There is no use trying to dodge the fact that corn will not make a full crop in Kansas very often. And when we do get a full crop it is still not as valuable as kafir put on the same ground and tended the same.

"Kafir can be made to reach the 40-bushel mark on any upland in Kansas by proper tending and selection of seed. I have grown it as a main crop from its first in-



Map Showing Areas to Which the Several Grain Sorghums are Adapted.—Prepared by G. E. Thompson, Superintendent of Kansas Branch Agricultural Experiment Stations.

troduction, and find it the equal of corn in all ways, and the fodder much superior to corn.

"The farmers of the state have been too careless in selecting seed, and have let it get too late in maturing. I have kept the time of ripening down to September 10, and anyone can do this by selecting the earliest heads for a number of years."

Adapted Sorghums and Areas. The preceding paragraphs have shown how the farmers of Kansas have distributed throughout the state the acreages of the several sorghums. The areas to which the sorghums are adapted as viewed by G. E. Thompson, superintendent of branch agricultural experiment stations in Kansas, are shown on a map which he prepared for Kansas Farmer following the 1913 season and which is reproduced herewith. Three members of the Manhattan Experiment Station agronomy force concurred with Mr. Thompson in his conclusions. The determination of these areas is the result of the experience of farmers of each section, combined with the results and observations of the branch experiment stations and co-operating demonstration farmers throughout the state. The sorghums adapted to each are:

"Area No. 1 in the map shows where dwarf milo, feterita and Freed sorghum have been grown successfully for the production of grain. Dwarf black-hulled kafir and white-hulled kafir mature grain in the more favorable seasons. Home-grown or northern-grown seed should be planted if obtainable. Freed sorghum and the early-maturing strains and black and red amber sorghum will mature seed. These varieties and kafir are all suitable for forage production.

"In Area No. 2, dwarf black-hulled kafir, white-hulled kafir, milo and feterita will mature seed in average seasons. The standard black-hulled kafir seldom makes a profitable seed crop. All varieties of kafir make excellent forage. Freed sorghum, amber sorghums and early-maturing varieties of orange sorghum do well in this area.

"Dwarf milo, feterita and Freed sorghum are at home in Areas No. 2 and No. 3. The kafirs are also dependable crops. Home-grown and northern-grown seed produce better in Area No. 2 than does southern-grown seed. Southern-grown seed can be planted with success in Area No. 3.

"Kafir does well in Areas Nos. 2, 3, 4 and 5. The dwarf black-hulled kafir and the white-hulled kafir give best results in Area No. 2, while the standard black-hulled kafir is the favorite variety for Areas No. 4 and No. 5.

"In Area No. 5, standard black-hulled kafir produces excellent forage, but is not satisfactory for grain yields. Orange sorghum is an excellent forage in this district."

Asked why kafir was not satisfactory in grain yields for this area, L. E. Call, Professor of Agronomy for Kansas Agricultural College, writes: "We considered this area so well adapted to corn that kafir was an unsatisfactory grain crop, as corn will produce on the same acreage a much larger quantity of grain."

Observations on Above Defined Areas. Feterita is undoubtedly the earliest maturing of the grain sorghums and, since it matured grain in Area No. 1 in 1913 in advance of killing frosts, it seems—for the present at least—deserving of a place in that section of Kansas having the shortest growing season. Reference to the map showing the number of days in the growing season in the different sections of Kansas, and to those maps showing the frost dates, will aid in understanding why early-maturing crops are desirable in the Northwest. In another chapter I have discussed feterita in such detail as the facts regarding its usefulness seem to warrant. Dwarf milo matured in 1913 in the same area and gave good yields. Reference has several times herein been made to Freed sorghum—which is of Western Kansas origin and which is being developed for grain production. The kafirs are not of sufficiently early maturity to produce grain in the average season of this area. How-

ever, twelve years ago when I spent considerable time in this section, red kafir was maturing with reasonable certainty. It would seem that the kafirs could again be made to mature here, but with feterita and dwarf milo already maturing grain and with kafir and cane for forage, little might be gained as a result of the expenditure of time and energy necessary to develop grain-producing strains of kafir for the extreme Northwest.

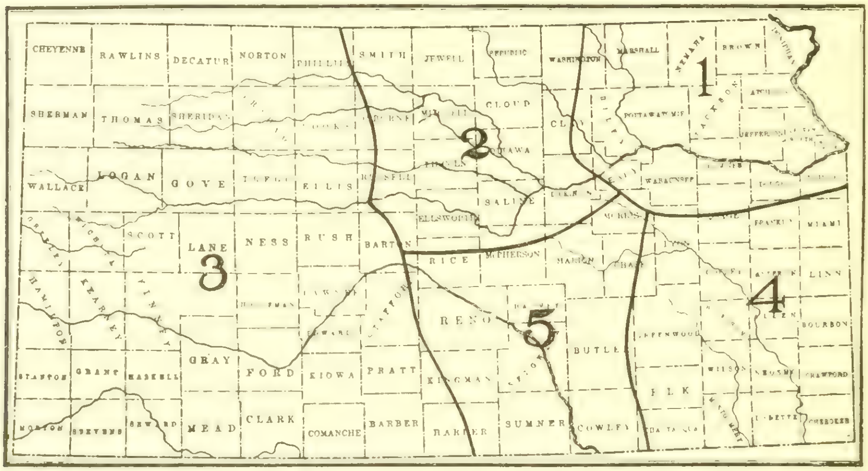
The dwarf black-hulled kafir recommended for Area No. 2 is a strain originated within the last few years by the Federal Department of Agriculture and is not as yet generally grown in Kansas. It is an important strain and I believe that through it will come the rejuvenating of the kafir industry of Kansas and Oklahoma. Its dwarfness is desirable, and its early maturity and purity will, if perpetuated by the farmer, re-establish kafir to the same degree of usefulness and grain dependability as it possessed twenty-five years ago.

The white-hulled kafir has been grown at the Hays Station for several years and it is believed to have come originally from a Russell County farmer. Regarding it, L. E. Call, head of the agronomy department of the Manhattan Agricultural Experiment Station, and who has supervision of agronomy work at Hays, says: "We have grown this variety at Hays with excellent success. We find it a little better adapted to conditions there than the standard black-hulled variety. It will mature in five days to a week earlier than the black-hulled, is a little more dwarfed in its habits of growth and a little more certain crop. We find it entirely satisfactory at Hays and as far as I know there are no objections to the crop when grown under Hays conditions."

Area No. 3 is reduced from the territory formerly regarded as that best adapted to milo, by placing Pawnee, Edwards, Kiowa and Comanche counties in the area of kafir. This is because in parts of the three counties first named the chinch bugs have done so much damage to milo that farmers have practically quit growing it.

Reference to the milo map will reveal that the milo acreage in the counties above named was small in 1912, and none of these has ever been in the list of the largest milo-growing counties of the Southwest.

Area No. 4 is that in which the standard black-hulled kafir is the most useful sorghum crop. If reference is made to the rainfall map for Kansas, it will be seen that



Map Showing Sections of Kansas to Which the Several Varieties of Corn Are Adapted.

this area includes the section of twenty-five inches or more of annual precipitation, and which area is the eastern half of the state with a wedge-shaped addition on the west. This is the kafir-growing area of Kansas for such standard strains as are now in use, but to obtain the best results the seed should be selected for purity, for early maturity and heavy yielding type.

Kafir is not popular with the farmers of Area No. 5, but we see no reason why they should not grow it to the same advantage as it is grown farther south in the eastern section of the state. Continued farming of the rolling lands of Northeast Kansas and the loss of top soil following years of soil washing, has made much thin land in that area which, if planted to kafir, will yield a greater acre income than if planted to corn. As the live stock

industry develops in this area there is no doubt but that farmers will be justified in giving more attention to kafir and cane since these, unquestionably, are to become the silage crops of Kansas. The farmer of Eastern Kansas who is so fortunate as to have bottom land, will grow corn and alfalfa thereon, while on his uplands he will grow kafir and cane because these will give him the greater tonnage of silage or dry roughage.

Adapted Corn Varieties for Kansas. It is not amiss that a discussion of sorghum-growing areas should be followed by a word relative to the several varieties of corn adapted to the several sections of Kansas. Be it understood that the varieties here designated are those which have been grown in and acclimated to the sections for which they are recommended, and are not those varieties of the same name which may have been grown in Northern Illinois or Iowa, or in other states under conditions of soil and climate widely varying from those prevailing in Kansas. In other words, choice, home-grown seed of the several varieties is recommended for the several sections indicated. The map and list of varieties was first printed in Kansas Farmer in the spring of 1913. The data were compiled from information obtained in every county of the state by the agronomy department of Kansas Agricultural College.

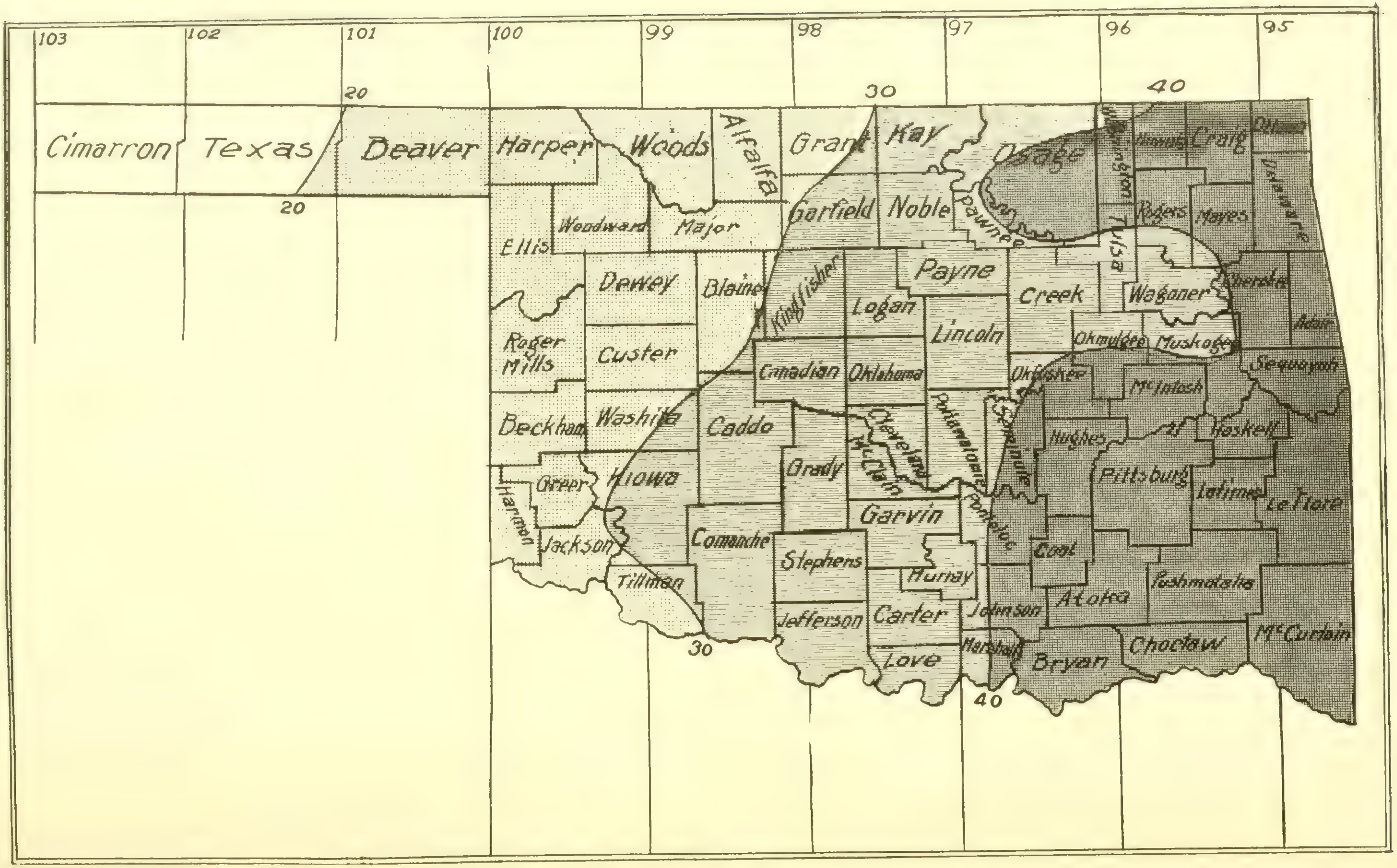
Section 1—Reid's Yellow Dent, Boone County White, Hiawatha Yellow Dent, Kansas Sunflower, local varieties.

Section 2—Kansas Sunflower, Iowa Silver Mine, Boone County White, Reid's Yellow Dent, Hogue's Yellow Dent, Nebraska White Prize, local varieties.

Section 3—Pride of Saline, Iowa Silver Mine, Albright, Calico, local varieties.

Section 4—Hildreth, Kansas Sunflower, Commercial White, Boone County White, Reid's Yellow Dent, Golden Beauty, local varieties.

Section 5—Kansas Sunflower, Hildreth, Boone County White, Iowa Silver Mine, Reid's Yellow Dent, McAuley, local varieties.



Map Showing Annual Precipitation of the Several Sections of Oklahoma.

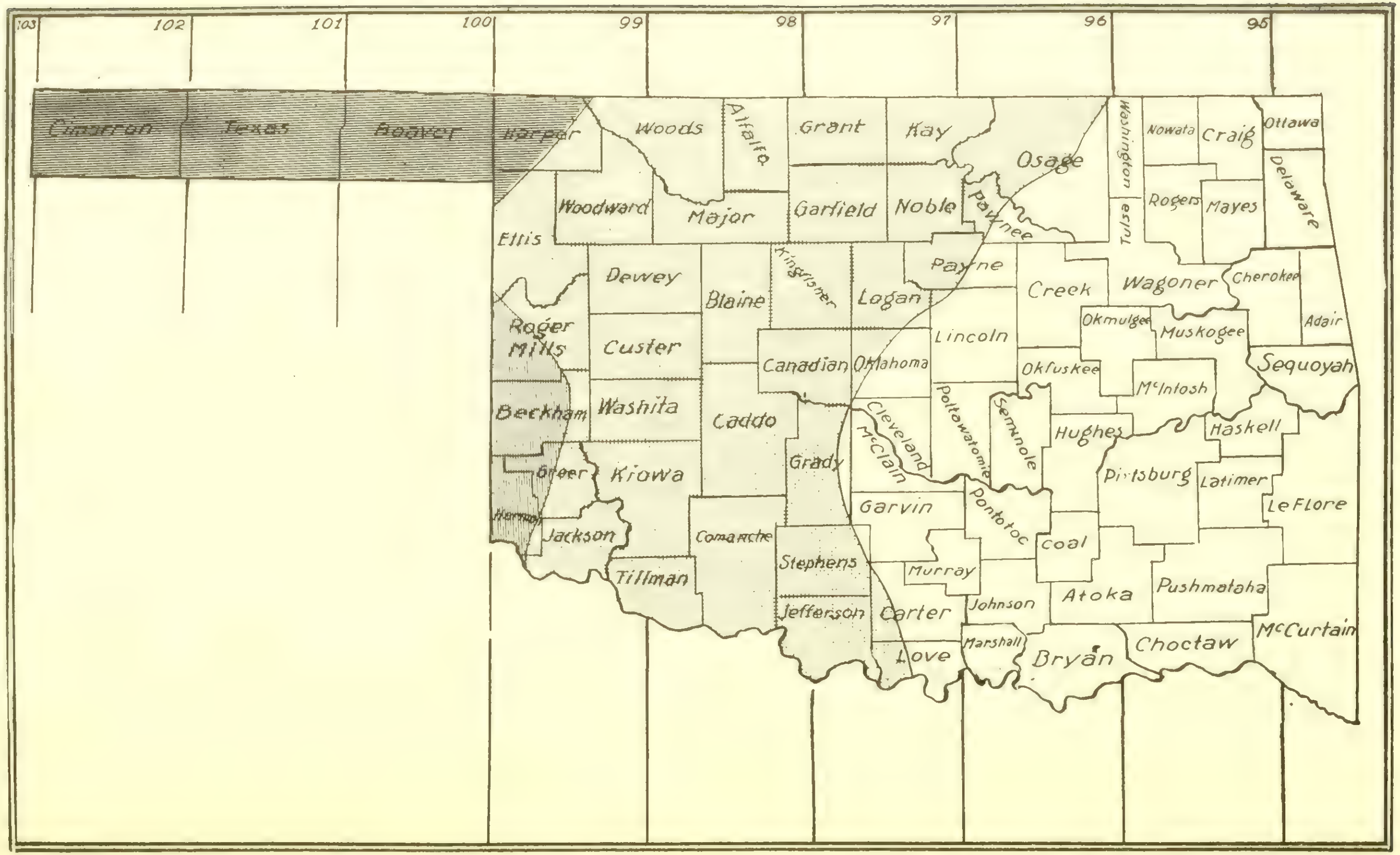
Besides these are many unnamed varieties of corn which give good comparative results for the sections in which they have for years been grown.

It will be many years, probably, before any considerable number of Kansas farmers will entirely discontinue corn growing. As evidenced by the records of the past, the western farmer is determined to grow corn. He loves the sound of the thump of the ear on the "bumping" board. But, if he must grow corn, he can well afford to plant only those varieties which have proven the best adapted to his locality, and should make every effort to secure such seed.

Oklahoma Sorghum Areas. Reference to the precipitation map of Oklahoma will reveal why the farmers of that state have established kafir and milo as the most successful grain and feed crops for the several sections. It will prove instructive to compare the Oklahoma maps with the corresponding maps for Kansas. This comparison shows that the sorghum-growing practices of the corresponding sections of the two states are quite similar.

The growing season of Oklahoma is longer than that of Kansas, but the annual precipitation is about the same, as is also the distribution of rainfall throughout the growing season. Thus, Oklahoma has the same need for early-maturing and dry-weather-evading crops as has Kansas. Oklahoma has one advantage over Kansas, however, in that sorghum crops which have failed to mature on the early rainfall have opportunity to receive the benefits of later rains and a better chance for maturity before killing frosts. However, following a dry midsummer in Oklahoma, as in Kansas, fall rains do not generally precede killing frosts sufficiently long to mature crops, so that those strains of crops which mature on the early rainfall are to be sought.

The map showing Oklahoma sorghum areas was redrawn from a similar map printed by the Oklahoma Farm Journal. The editor, John Fields, has carefully studied the adaptability of the several sorghums to each area.



Map Showing Grain Sorghum Areas for Oklahoma. Milo for Dark Shaded, Kafir for Light Dotted, and Kafir for Uplands in the Unshaded Sections.

His conclusions are based upon his investigation of the performance of the several crops on the farms of the respective sections. He thus explains the map:

"For the dark shaded area, milo is the chief grain crop, with kafir as a supplemental crop for forage. The sweet sorghums are satisfactory for forage in this area, except, possibly, in Cimarron County and the western part of Texas County.

"The next area east, or that light-dotted in the map, is the area in which kafir is the chief grain and forage crop. Milo is recommended as a supplemental grain crop for planting on wheat and oats stubble and where cotton fails to make a stand.

"In the unshaded area farmers should adhere closely to kafir and corn and plant but little milo." Mr. Fields recommends that in this area corn be planted on bottom lands only.

Farm by Safe System. A farming system that is really "safe"—dependable—will appeal to every farmer. Such system is that for which every farmer is working and hoping. Some are seeking it more persistently than others. Many are not seeking it—at least, not working for it—but are hoping that it will be evolved and handed them, ready-made, and guaranteed proof against failure. The most dependable system of farming will come only to the man who works it out for himself. The same "system" will not work with all farmers, nor on all farms in a community, and may not work even on adjoining farms. But with every sorghum belt farmer and on every sorghum belt farm the same principles are involved in any successful farming plan. These have been set down for Oklahoma by Mr. Fields, and so well do they apply in general to Kansas and other parts of the sorghum belt, that they are here printed:

"A system of farming, based upon experience and experiment in Kansas, Oklahoma, and Texas, where rainfall is always variable and often deficient, and where strong winds and high summer temperatures introduce

conditions unknown to farmers of the Northern and Atlantic Coast states, has been developed and should be generally adopted.

"The general plan of operation should be the following:

"Corn should be planted only on lands which have yielded not less than twenty-five bushels of corn to the acre, at least one year in the last five.

"Every acre of rich, well-drained bottom land which does not overflow frequently or for long periods of time should be put to alfalfa as soon as possible.

"The smooth, tillable uplands and prairies should never be planted to corn. They should instead be planted to kafir, milo, or some other variety of sorghum for a sure crop of grain for feed and sale, and for filling silos and providing rough feed; to peanuts and cowpeas for feed and forage and soil improvement; and to cotton, wheat, oats and broomcorn for cash crops, wherever soil and climate are suitable.

"The washy soils, hillsides, rough places, alkali lands, and overflow bottoms should be set to hardy bermuda grass, wherever this grass thrives.

"Those who follow a safe system of farming such as this, modifying it to fit local conditions, and feed most of their crops to good live stock, will be the ultimate owners of all the good farms in the Southwest."

With the above should be read these paragraphs from one of Mr. Field's editorials under the heading, "Pursuing a Phantom," and in which he recites the advantages of growing the sorghums as compared with growing corn in the several sections of Kansas, Oklahoma and Texas. He says:

"In Texas, the development of the immense area west of the line of thirty inches average annual rainfall has been hampered and delayed by continuing attempts to grow corn where corn will not mature a paying crop.

"The production of corn requires more than a fertile soil; the kind of sky under which it is planted is fully

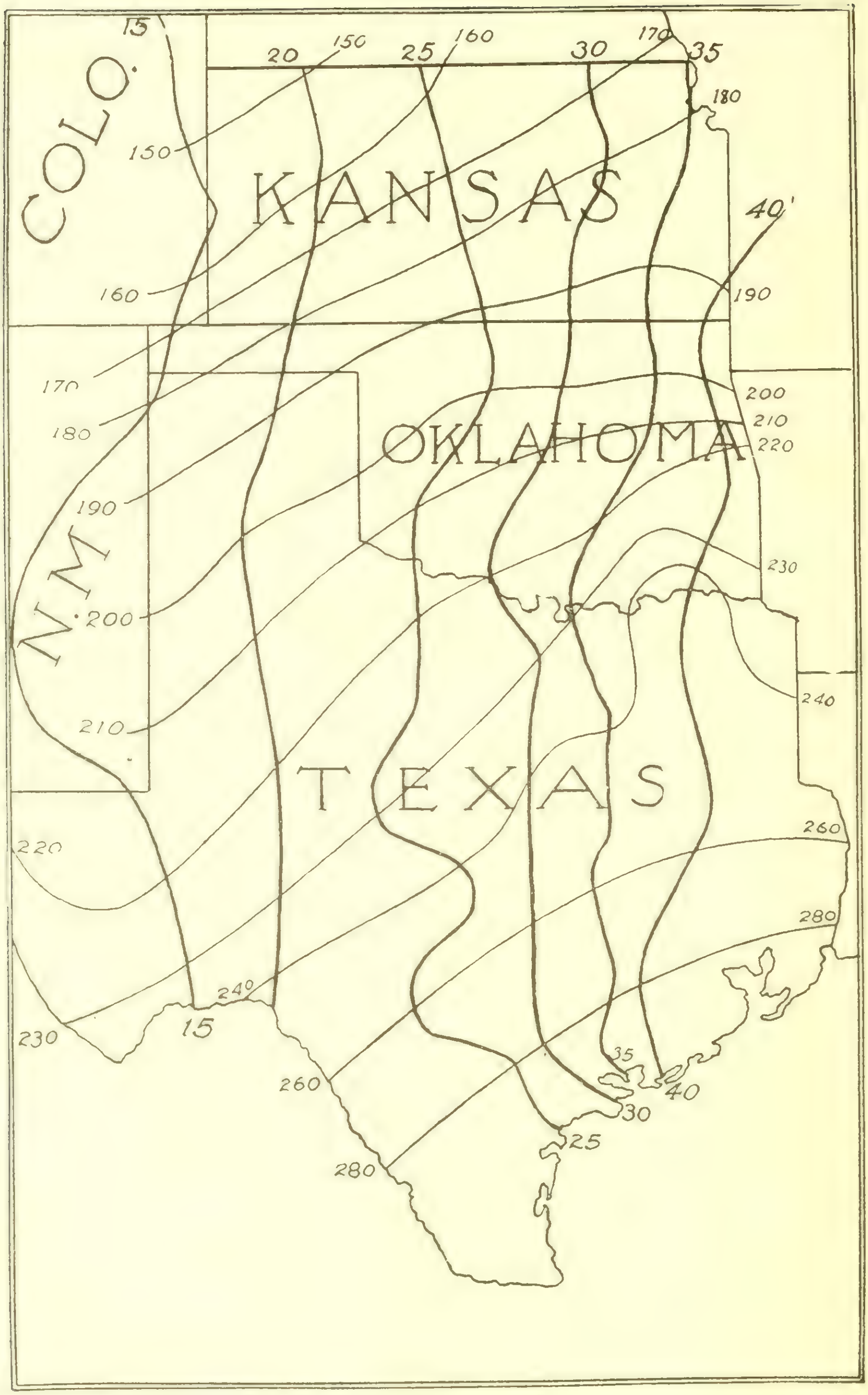
as important as the quality of soil. And in persisting in attempts to make of corn a profitable crop where its frequent failures have brought repeated disasters, 'each pursues his favorite phantom.'

"No appropriations for 'soil surveys' are necessary in order to determine the lands where the chances are at least one to five that corn may produce a profitable crop. Every man who owns a farm may determine it for himself by considering his own corn yields during the last five years.

"Sure feed crops—the kafirs, peanuts, cowpeas, and alfalfa—and live stock to consume them, should be considered first and cash crops second, when attempting to forecast the net financial outcome of a season's operations on any farm."

Milo and Feterita as Catch Crops. The use of milo and feterita as catch crops is important to the Oklahoma farmer. In normal seasons they well serve such purpose. The longer growing season in that state, as compared with Kansas, will permit them to mature grain following the early harvest of other crops. The suggestion of such usage is worth investigating on the part of Kansas farmers in the one or two southern tiers of counties and east of Barber and Kingman counties. In this locality when the ground has considerable moisture following early harvest, milo and feterita will grow extra grain, acceptable to most farmers, if planted as catch crops. This is a plan which cannot be successfully practiced far north of the south line of Kansas and ordinarily will not be successful on the south line of the west half of the state.

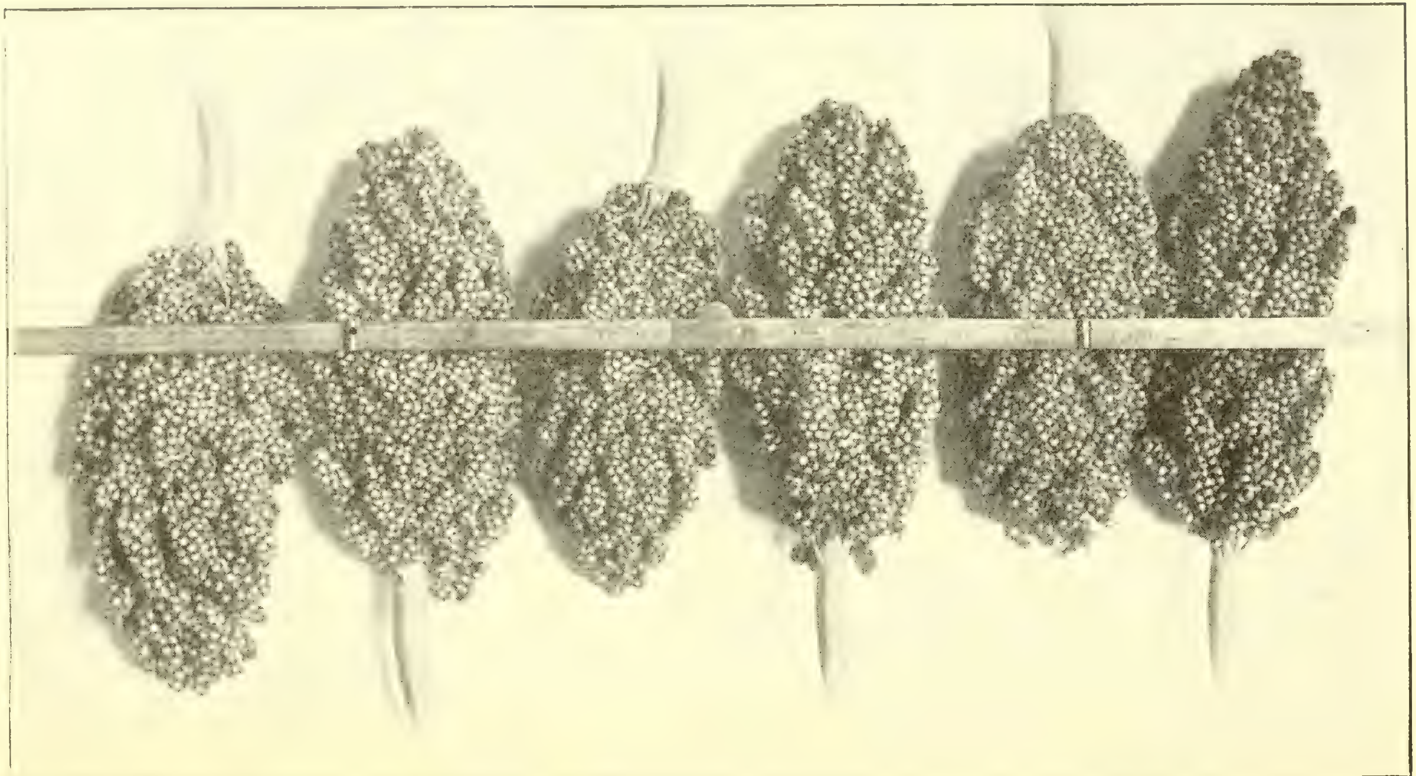
Precipitation and Growing Season for Sorghum Belt. The map on the following page is that of the sorghum belt. It shows the several precipitation belts extending from the southern to the northern boundary, also the average number of days in the growing season of the several sections beginning at the gulf on the south, and extending to the Kansas-Nebraska line. The lines running north and south, or from top to bottom, mark the precipitation



Map of Sorghum Belt, Showing Annual Precipitation and Days of Growing Season for the Several Sections.

of the several areas, the figures showing the annual precipitation for the territory included between the lines. Those lines extending from left to right, or across the map, mark the average number of days in the growing season for the several areas. This map illustrates on a single page much of the preceding discussion. The data making this map possible were compiled after the foregoing maps had been prepared and the explanation put into type, else the general plan of presentation might have been changed. The map is the result of months of correspondence in an effort to obtain the data which would permit the placing of a particular line thereon. The figures were not obtained in time to allow the use of the map in the way originally intended.

Where to Grow Kafir, Milo and Feterita. One of the most careful students of the annual precipitation required by the several grain sorghums is H. E. Horton, Agricultural Commissioner of the American Steel and Wire Company. For his company Mr. Horton has spared neither time nor money in an effort to locate the areas to which kafir, milo and feterita are best adapted. Aside from personal familiarity with grain sorghums and sorghum areas, he has enlisted the aid of farmers, agricultural experiment stations, co-operative demonstration farmers, and county agricultural agents, in arriving at his conclusions. His company has been active the past few years in acquainting the farmers of the Southwest with the sorghums. This is a splendid example of a corporation employing the best talent at its command in the search of information which would point its patrons to a greater prosperity. This company has spread Mr. Horton's findings through pamphlets and posters to every farmer and business man in the sorghum belt and its tons of printed matter have done much toward extending the acreage of sorghums and to bring about a more general use of and dependence in them. As a result of Mr. Horton's investigations he prepared a poster, which was distributed in the spring of 1914, on which he



Typical Heads of Pure Dwarf Milo Grown in Western Oklahoma, 1913, and Shown at International Dry Farming Congress.

assigned kafir, milo and feterita to the areas of precipitation described below:

For 40 to 50 inches of annual precipitation: "Plant kafir only as substitute for corn, milo incidentally."

For 30 to 40 inches: "Plant kafir only as substitute for corn, milo for late planting, feterita incidentally."

For 25 to 30 inches: "Plant kafir and milo as a substitute for corn, feterita as alternative for milo."

For 20 to 25 inches: "Plant dwarf kafir and dwarf milo for grain, feterita for hogging down."

For 20 inches of annual precipitation and less: "Plant dwarf milo and perhaps feterita for grain."

After reading the above, refer to the map on the opposite page. Study the map, locate your farm and, with the annual precipitation in mind, choose the crop to grow. There are 200,000 square miles in the Southwest particularly adapted to growing the three crops—kafir, milo and feterita. There is a place for each of these crops and no one should be grown to the disadvantage and elimination of the others. The above statements by Mr. Horton are brief and necessarily so on account of the manner in which he used them. These explanations seem warranted inasmuch as I feel safe in interpreting his thought:

For the area of 40 to 50 inches of annual precipitation, standard black-hulled kafir should be planted on all uplands. Milo may be planted after July 1. If the fall is wet, as in 1913, the crop will be seriously damaged by the seed germinating while still on the stalk in the field.

Where the annual precipitation is 30 to 40 inches, plant black-hulled kafir in the place of corn on all uplands and for late planting on bottoms. Plant milo after July 1, on uplands. Feterita may be planted after July 1 for a trial.

For the area of 25 to 30 inches, black-hulled kafir is the standard grain crop for all uplands and for a considerable part of the bottom lands. If planting is done

after July 1, use milo. Feterita may be tried on a small scale on each farm.

Where 20 to 25 inches of precipitation is received, black-hulled kafir is the standard grain on the best lands and dwarf milo on the uplands, particularly where they are heavy. Small areas of feterita may be planted as an experiment.

For the area of 16 inches or less of annual precipitation, feterita promises to become a standard crop, although in those sections of Colorado and New Mexico on sandy lands milo has to date given the highest yields.

"Be careful! The adaptability of a crop for a locality is only proven after at least five years' growing and careful comparison with other crops under identical conditions. Don't give up kafir growing without the five-year reason," is a caution which Mr. Horton includes in his poster. There is much good sense in those few lines. Do not be in too big a hurry to determine the value of any new and untried crop. To try a few acres of a promising crop is worthy of commendation. Give it several years of trial. Do not be governed by a single year's showing.

GRAIN SORGHUM FARMING

There is little doubt that the sorghum acreage in the better corn-growing sections of Kansas, Oklahoma and Texas, would at this time be greater except for the prevailing belief that all sorghums are "hard on the land." Years ago I sent a friend in New York State a half bushel of alfalfa seed with instructions for planting. Fortunately he obtained a fine stand and secured good yields. After a few years he plowed up the field because of the fear of his adjoining neighbors that alfalfa would prove a pest and take their farms. At this time New York farmers are in many instances actually making over their land that they may grow alfalfa. To the Kansan, who knows better, the fear of the New Yorker is ridiculous. But his mistake is no more inexcusable than is that of Kansans who refuse to grow sorghums and so avail themselves of the surest feed crops, because of the fear that they are "hard on the land."

Farm lands are of no value unless they are made to produce useful and profitable crops. Nothing is gained by maintaining or accumulating soil fertility unless that fertility is put to work and adds something to the sum total of the country's prosperity. The adaptability of the crop to the soil and seasonal conditions and its usefulness in the general plan of farming, should govern the kind of crop grown. For every section there is a cropping plan by which the fertility of the soil can be conserved and which farming methods will so operate as to prove more profitable than if plant food is used extravagantly or wasted. Indeed, on many farms the greatest loss in fertility is not through that actually used by crops grown, but through generally poor soil handling. There is no good reason why sorghums should not be grown by

the farmers of any section whose needs and conditions demand such crops.

The sorghums leave the land dry, and unless plowing is preceded by liberal moisture, the soil turns up lumpy and in bad physical condition generally. It is well known that wheat or rye drilled in sorghum stalks or stubble the fall following the sorghums, usually does not grow well and the crop often fails. This condition, no doubt, is responsible for the common belief that sorghums are "hard on the land." The failure of these crops following sorghums is not due to lack of soil fertility, but to lack of moisture and *available* plant food. The absence of the moisture needed, immediately after planting, is generally recognized as the principal contributing cause for the failure of small grain crops to do well when seeded in the fall following the harvesting of a sorghum crop. Sorghum lands should be thoroughly disked or plowed immediately after the removal of the crop. This gives the land a chance to absorb moisture, which, with the winter's freezing, will put it in condition for successful seeding the following season. The successful growing of other crops on sorghum lands, as is indicated by experience and observation, is wholly a matter of soil handling, as is evidenced below.

Oklahoma Station Figures. The Oklahoma Agricultural Experiment Station reports the amount of plant food removed from the soil by 30 bushels of kafir as compared with 30 bushels of corn, as follows: Kafir removes 32.9 pounds of nitrogen; 6.5 pounds potassium oxid, and 10.4 pounds phosphorus pentoxide. Corn removes 30.6 pounds nitrogen; 6.8 pounds potassium oxid, and 11 pounds phosphorus pentoxide. It will be noted that the difference in the amount of each constituent of plant food required by an equal number of bushels of the two crops is too small to take into account in farm practice. The chemist who made the above figures, adds: "It must be concluded that kafir is not injurious so far

as the chemical constituents of the soil may be concerned."

Successive Kafir Cropping at Manhattan. Kafir has been grown on the farm of the Manhattan, Kansas, Agricultural Experiment Station each year since 1889 without apparent damaging effect on the soil. On several fields kafir has been grown several successive years with no perceptible shortening of yield of succeeding crops. This has also been the experience of many good farmers with whom I have talked. However, the practice of successive kafir or cane cropping is not to be commended, more than the growing of wheat or corn on the same field for many successive years. The effects of sorghum cropping are most noticeable in the case of wheat in the fall or oats in the spring—crops which need moisture at once and before the cultivation of the sorghum land will permit the accumulation of normal moisture and the mellowing of the soil by the elements, and this is the observation which has inspired the "hard on land" idea.

Federal Department of Agriculture View. "It is maintained that when land has become too poor and thin to raise corn or small grains, two or three good crops of sorghum may be obtained from it and the land will be left in better condition for corn, cotton, and other surface feeding crops," says Farmers' Bulletin No. 50, of the Federal Department of Agriculture. "In California and elsewhere good yields are obtained on soils containing a high percentage of alkali and hence it is regarded as a good crop to use in rotations for such lands.

"Sorghum is generally regarded as harder on land than corn, and this is undoubtedly true to a great extent since it is a deeper feeder and two or more crops are often harvested in a single season. Still, there are many instances of sorghum being grown on the same field for many years without any apparent lessening of the quantity or quality of the crop from the impoverishing of the land, and there are many soils that are undoubtedly benefited by the deep-growing roots of the sorghum

plant. * * * As sorghum is grown in many places, it is certainly not as hard on the land as most other crops. When planted late, sown with cowpeas or field peas, and cut before the seeds ripen, the land is left in excellent condition, especially if it is plowed soon after the crop is taken off."

Scene on Farm of E. S. Rule. Barber County, Kansas.—Dairy Cows Fed Kafir Silage Make Big Money on This Farm.

The "sorghums" to which reference is above made are the sweet sorghums or those commonly designated as cane.

Thinks Kafir Benefits Land. "That kafir is hard on land, is all nonsense," writes J. C. McClellan, land owner and president of the Tradesmen's State Bank of Oklahoma City. "Kafir grows long after frost has killed other crops and as long as it grows it draws moisture from the ground and consequently leaves the ground dry. So many farmers fail to plow this land in the fall or winter and when they try to plow it the next spring they find it dry and soddy and jump at the conclusion that

kafir is hard on the land. Every farmer should fall plow the kafir fields.

"Kafir forces the farmer to fall or winter plow, and for that reason alone is one of his best crops. On land where I grew forty bushels of kafir per acre, I grew thirty-five bushels of oats per acre the spring following. I believe the kafir actually helped the land.

"Many farmers plant kafir on their poorest land. I say no land is too good for kafir. The better the land, and the oftener the kafir is cultivated, the better the quality and the larger the yield. The day is coming when kafir will be the standard feeding crop of the Southwest. Kafir silage is a money-maker for cattle men. I am for kafir because it is a sure, safe crop, specially adapted to Oklahoma."

Rotation for Sorghum-Growing Farms. It is apparent from the condition in which the sorghums leave the soil, that a method of soil handling is necessary which will give opportunity to restore the normal physical condition before other crops are planted. This is accomplished by a rotation of crops, which is not only beneficial to the soil in overcoming the effects of sorghum growing, but which results in better yields of all crops and in the most profitable use of the soil. Crop rotation is needed to permit conservation of moisture, the liberating of plant food and the maintenance of a permanent system of agriculture. To accomplish this, farmers must grow, in rotation with each other, crops which feed differently on the soil—that is, to different depths, and which take from the soil the different elements of plant food in different quantities and combinations, and which have different physical effects on the soil.

"The best crops to plant after sorghums are those that are not planted for several months after the sorghum crop is removed or until late in the spring," writes A. H. Leidigh, assistant professor in crops at the Manhattan, Kansas, Agricultural Experiment Station. "In Central Kansas these are such crops as the sorghums, corn, mil-

let, or cowpeas. In Western Kansas, the best policy is to attempt to accumulate even more moisture than can be secured by the time for seeding the above crops. To do this, a spring-plowed, summer-fallowed field, which is the highest type of dry farming, is needed. The aim of the fallow is to accumulate in the soil a supply of moisture to last for several months. After the fallow, winter wheat may be sown on sorghum fields and no doubt entertained as to its successful growth.

"Any field which is kept in a bare condition and cultivated to conserve moisture and prepare plant food, is said to be fallow. Such a practice is a very profitable method of farming, where irregularity in the rainfall is feared or where enough moisture cannot be secured for the crop by following ordinary methods."

Rotations for Kansas. The following rotations for Kansas are recommended by W. M. Jardine, director of the Manhattan, Kansas, Agricultural Experiment Station:

"First year, sorghums, kafir or milo for grain or sweet sorghum (cane) for forage.

"Second year, summer fallow. The sorghums leave the ground depleted of moisture and *available* plant food and the fallow brings the soil back to normal condition ready for wheat. The fallow is followed by wheat.

"Thus we have two crops in three years—one of sorghums and one of wheat—two money crops for Western Kansas. If properly carried out, this rotation will almost insure two good crops in three years. Whenever practicable, with this rotation we advocate the planting of fall rye after removing the sorghums, or at any time after the last cultivation is given. If the fall happens to be wet the rye will make splendid pasture. It undoubtedly will make good spring pasture and can be plowed under any time in May, or even to the middle of June. The land should then lie cultivated—not in a dusty condition, for in this condition the soil would blow—until wheat planting time in the fall.

"As we proceed eastward from the western boundary of Kansas the moisture gradually increases, so that in the vicinity of the 100th meridian we have a rainfall of approximately 22 or 23 inches annually.

"Under this rainfall we believe the following rotation will make the farmers the most money: Summer fallow followed by winter wheat two years in succession, the ground for the second crop of winter wheat being listed or plowed as early as practical after the first crop of wheat has been removed, the second crop of wheat to be followed by a sorghum crop. This gives three crops from the land in four years, while the first named rotation, the one we recommend for more severe conditions as regards drouths, brings two crops in three years."

The Eastern Kansas farmer, whether or not he grows sorghums, needs a crop rotation, but it is not within the scope of this book to enumerate all the cropping combinations which can be used to advantage in the different sections of the state. The farmer of every section should understand why a proper succession of crops is necessary and then perfect a system of cropping adapted to his conditions and needs.

Rotations for Oklahoma. The Stillwater, Oklahoma, Agricultural Experiment Station recommends the following rotations for sorghum-growing farms:

"Rotation 1: First year cotton, second year kafir or milo, third year oats and cowpeas.

"Rotation 2: First year cotton, second year kafir or milo, third year wheat and cowpeas.

"In the above two rotations cowpeas are sown after the oats or wheat are harvested and the crops are plowed under as green manure.

"Rotation 3: First year wheat, second year kafir or milo, third year cowpeas, fourth year wheat and cowpeas.

"Rotation 4: First year wheat and cowpeas, second year kafir or milo, third year cowpeas, fourth year corn.

"In the third rotation cowpeas are used the third year

as a regular farm crop, and the fourth year plowed under as green manure. In the fourth rotation cowpeas the first year are used as a green manuring crop, and third year as a farm crop."

Field of Mongrel Kafir Grown in Western Oklahoma, 1913.—Badly Mixed with Cane and Broom Corn.—Yield of Grain and Forage Low.

Cane Varieties. Since the sweet sorghums or that family of plants commonly called "cane" are not grown for grain for feeding purposes, they have generally been given little consideration in the matter of selecting varieties best adapted to the farmer's conditions or in keeping the seed pure. They are mostly grown for forage, and generally speaking, all cane forage is regarded as of equal value. However, there is a difference in time of maturity, dry weather resistance, tonnage yield, and in the character of the forage, which makes adapted cane as essential as adapted grain sorghums, for the several sections.

For the best cane forage it is necessary that the crop reach maturity before killing frosts, since at that stage it possesses the highest feeding value. So there are early-maturing varieties for high altitudes and short growing seasons, and medium late varieties for the lower altitudes and longer growing seasons, the height of stalk and yield varying correspondingly. There are varieties more leafy than others, and which, on this account, make better forage. Some varieties produce more seed than others and as a cash market crop have a great advantage over the lighter seeded kinds. The seed of pure strains of any adapted crop gives seed and forage yields superior to the seed of mixed strains, and even in growing cane the application of the same intelligent selection and care as in the case of other crops, will pay.

The leading varieties of cane adapted to the several sections of Kansas are briefly described on page 53, but the situation warrants this detailed description published in the Sorghum Primer, a book distributed by the Kansas Agricultural College in 1912:

AMBER. "Amber is a thin-stalked, narrow-leaved, early-maturing variety. There are many different strains of amber sorghum. The most important are black amber and red amber. Amber is useful as a catch crop variety or for the production of early feed or for syrup in Central and Eastern Kansas. In Western Kansas it is the best saccharine variety. On account of the altitude, which shortens the season in that part of the state, many other sorghums are unable to ripen, whereas amber usually will mature fully before frost."

ORANGE. "Orange sorghum is a very popular variety. It is medium late in maturity; has a medium heavy stalk, and fairly wide leaves. The head is somewhat bunched, and appears orange, or dark orange-red, in color. This sorghum is raised all over Kansas, and is used for all purposes to which a saccharine sorghum is suited."

SUMAC. "Sumac is a late broad-leaved variety. The head has an erect, stocky appearance. The head is small,

compact, and of a wine color. The sumac sorghum seed is the smallest of any of our important varieties. The black glumes are short and scarcely surround one-half of the seed. Because of the smallness of the seed, the variety is an especially cheap one to buy for seeding, since there are many more seeds in a bushel than is the case with the large-seeded varieties. This variety is especially desirable for silage and for syrup."

GOOSENECK. "This is the only saccharine variety having pendent or 'gooseneck' heads; some of the heads do not hang down. It is a late-maturing variety, with tall, thick stalks. The leaves are very long and broad. The heads are somewhat compact and more than one-half as wide as long; black in color, due to the black silky glumes which almost hide the rather small reddish seeds. Gooseneck is not widely grown, but is a valuable syrup variety."

Kafir Varieties. In the preceding pages such frequent reference has been made to the several varieties of kafir as to make extended reference here unnecessary. However, it seems essential that it be understood that the standard black-hulled kafir of pure strain and of home-grown seed is the variety which will give the best results in the eastern two-thirds of Kansas, Oklahoma and Texas—the section of those states having the longest growing season and the heaviest annual precipitation. The dwarf black-hulled as it is being developed at the Hays, Kansas, Agricultural Experiment Station, is specially adapted to the sections of lighter precipitation and shorter growing season. Its dwarfness makes it desirable from a harvesting standpoint since its heads can be gathered with an ordinary wheat header. The Hays station, as formerly reported, is developing a white-hulled—which is not the white-hulled of twenty years ago—that is of earlier maturity and more dwarfed in its habits than the dwarf black-hulled.

These two latter sorghums are especially promising for Western Kansas. The available seed supply of these is as yet limited. As farmers are able to obtain seed of

such strains they should be careful to maintain purity and so receive the benefits of those characteristics which make them valuable—dwarfness and early maturity. The dwarf and early-maturing varieties of kafir are important to Western Oklahoma and Texas, and are now more generally grown there than in Kansas.

The red and white varieties of twenty-five years ago are no longer generally grown. The red then grown was of early maturity, but a light yielder. The white was later in maturity and a heavier yielder, but the heads failed to shoot clear of the boot and this fault was so objectionable as to place the variety in great disfavor. The markets for kafir have been established on the black-hulled and the standard and dwarfed of this variety are those which seem to warrant general patronage from a marketing standpoint.

Milo Varieties. The improved and dwarfed milos possess the same advantages for the milo-growing sections as do the corresponding varieties of kafir for those sections having a precipitation and length of growing season adapted to kafir. There are numerous varieties of milo and they are more varying in their manner of growth than the kafirs as we know them. The original and unimproved varieties grew from three to ten feet high, and the heads were pendent or goose-necked. The goose-necked heads were a nuisance from every standpoint in harvesting, storing and feeding. The stooling and branching was objectionable because each stalk produced a head, these ripening at different dates but none as early as the main head. Uniform height and ripening are necessary in any grain crop if the harvesting is to be easy and effective.

Beginning about 1903, the development of milo as a grain crop has progressed rapidly by selecting seed and propagating plants with desirable characteristics. Selection has resulted in obtaining uniformity in height, in practically eliminating the pendent head, stooling and branching have been almost wholly overcome, and earlier

maturity has been obtained. Since the tendency of the plant is to revert to its original form, it is apparent how careful the grower should be in selecting seed if he would maintain the desirable characteristics.

The milo now regarded as of greatest value in Texas, Oklahoma and Kansas, is the improved yellow milo which has been dwarfed to a uniform height of four and one-

Freed Sorgo or Cane—Developed by J. K. Freed, Scott County, Kansas.—Especially Adapted for Seed for Production in Western Kansas.

half feet when growing at an altitude of about three thousand feet, but growing taller or shorter as the growing conditions are more or less favorable. A true dwarf strain with erect heads, growing three to three and one-half feet in height, has been developed during recent years and is by growers regarded as the most desirable variety.

The milo introduced into Southwestern Kansas in 1906 by the Kansas Agricultural College and the Federal Department of Agriculture, was dwarf yellow milo. The

results have been remarkable, although the introduction was undertaken at a time when conditions were extremely unfavorable. The success of milo in this instance is a good example of adaptation. The seed was introduced from farther south than the adaptability of the plant justified and at first it was not so successful as was expected. But the continued selection and planting of home-grown seed, after a few years made it adapted to the existing conditions. This seed was gradually moved north across the state until it reached the north line and in so unfavorable a season as 1913 milo matured in every county in the western third of Kansas. This performance teaches an important lesson in the desirability and the value of acclimated seed and shows how necessary it is that the farmer exercise great care in selecting from his own fields such seed as he needs for planting, or at least the planting of seed grown in his community.

Kansas Milo Yields. I have met many farmers in the milo growing area of Kansas who knew little about the crop and their first question was, "What will it yield?" This is a pertinent question regarding any crop. However, many a man who should be thankful for an average 10 or 12-bushel acre yield during a ten-year period, will condemn a crop because he thinks a crop yielding less than thirty-five or forty bushels is not worth while. What the sorghum belt needs is a crop that is near certain of yielding something in the most unfavorable seasons. We have seen milo yields varying from nothing to fifty-five bushels in the same season on adjoining farms. The varying yields have not been wholly the fault of milo as a crop. There were other reasons controlled only by the grower. We have known of 100-bushel acre yields in Kansas.

During the summer of 1913 Kansas Farmer addressed letters to a number of growers in each of the counties of the western third of Kansas, asking them to report their growing methods and success with milo. The replies on several points will be printed in this and follow-

ing chapters. A summary of these reports on yields for a period averaging six years, shows acre yields ranging from nothing to 66 bushels. Many correspondents reporting stated that they never threshed milo but fed it in the head and could not make a bushel yield estimate. The replies showed greatly varying preparation of the seed bed, planting methods and source of seed, account-

Field of Well-Bred Kafir Grown Near Weatherford, Oklahoma, 1913.

ing for the varying yields on farms in the same locality. Here are some acre yields:

Have never measured; about 15 bushels I would guess. —H. C. La Tourette, Decatur County.

About 40 bushels in 1912.—C. A. Calkins, Hamilton County.

From 10 to 15 bushels.—A. L. Hicks, Norton County.

Ten to 15 bushels.—C. R. Henry, Cheyenne County.

About six bushels.—George Shields, Sheridan County.

From 15 to 23 bushels.—Agricultural Experiment Sub-station, Ford County.

Fifteen bushels per acre.—Lee McKissick, Clark County.

From 50 to 66 bushels to the acre.—J. W. Patterson, Stevens County.

From very small yields up to 36 bushels.—C. W. Askew, Ness County.

We estimate 20 bushels, but as we feed so much before threshing this is only an estimate.—Monroe Traver, Stevens County.

Twenty to 40 bushels.—J. A. Clark, Ness County.

Seventeen bushels.—C. M. Jennison, Lane County.

Have had yields as high as 50 bushels but the whole crop does not yield over 20 bushels usually.—M. L. Brooks, Scott County.

On account of chinch bugs, my 1912 yield was not as good per acre as kafir—about seven bushels per acre.—G. J. Stauth, Ford County.

Fifteen to 40 bushels.—M. C. Campbell Ranch, Clark County.

Methods of Seed Bed Preparation. A good seed bed for corn will prove a good seed bed for the sorghums. The grower of sorghums should not be content with less preparation than he would give for corn. In the proportion that the conditions are adverse to crop growing, in just that proportion should attention be given to the more thorough preparation in advance of planting and to proper cultivation during the growing season. The field should be prepared with these objects in view: To store and conserve moisture, to permit of deep rooting by the plant, and to free the ground from weeds. The cultivation should be effective in conserving moisture and in preventing weeds from utilizing soil moisture needed by the crop.

The heavier soils should be thoroughly plowed at least every other year. Such soils are those generally prevailing in Kansas, Oklahoma, and Texas, east of the 98th meridian and having 30 to 40 inches of rainfall. They are not generally subject to serious damage by

blowing. Deep fall plowing alternated with fall listing or early spring disking will give good seed bed results in such sections. This treatment will increase the moisture-holding reservoir, maintain a condition favorable to moisture accumulation, and will permit of deep rooting by growing plants in seasons when surface moisture is insufficient.

Deep plowing of the lighter soils west of the 98th meridian in Kansas, Oklahoma, and Texas, is not so beneficial or necessary as in the case of the heavier soils, but it is essential that methods of soil handling be followed which will permit of moisture accumulation. Such methods involve deeper plowing than is ordinarily practiced. It is certain that shallow plowing year after year, and disking without plowing year after year, is responsible for much of the damage done by soil blowing in the West. Both operations should be carefully done in the West and Southwest. The details of western soil handling methods are described below by men whose work in the field has demonstrated the practicability of such methods:

Western Kansas Practices. Agricultural Agent Clyde McKee found these methods of soil handling satisfactory in Northwest Kansas:

"Fall listing seemed to be exceedingly beneficial; it holds snow, prevents soil washing, and conserves moisture. It is more economical than plowing and should be done in the fall as early as possible. Listing is the surest method of preventing soil drifting.

"Double listing in the spring in preparation for spring crops was not very successful; this method probably should not be used if the listing is not done immediately after the frost leaves the ground. If there is any delay, disking is to be preferred.

"Early disking in advance of listing for spring crops gave splendid results. In general, the ground listed easier and a better stand was obtained, crops made a better early growth, land was free from weeds and cul-

tivated easier. On one farm, early disking for corn increased the yield one-third over that obtained from ground not disked and similar results were obtained on many farms with sorghums."

Implements for Soil Cultivation. Director Jardine of the Manhattan, Kansas, Agricultural Experiment Station, writes:

"Almost invariably when we propose that the farmers summer fallow a portion of their land, they protest by saying that if they till their land as is usually prescribed in the summer fallow, it will all blow away before planting time.

"We are attempting, therefore, and with complete success, to maintain a summer-tilled field so that its soil will not be shifted and blown away.

"We have used and are now using different tillage implements for this purpose. The disk harrow, so commonly used in cultivating the fallow, is a dangerous tool to use in Western Kansas on the summer fallow. It pulverizes the top surface too completely; that is, it leaves the soil too fine ordinarily. The sugar beet cultivator and the John Deere alfalfa cutter that runs on wheels, are the two best implements we have thus far found with which to till the fallow and to prevent the soil from blowing. Weeds can be effectively kept down with either of these implements and the top soil maintained in a cloddy condition rather than pulverized.

"Ground that is plowed thoroughly to a considerable depth in May after the most severe winds are over, and then worked with either of the two implements above mentioned, is left in good condition to absorb the rainfall and to retain it thereafter. In handling the summer fallow, or in fact, in working any of the land in Western Kansas which we have under our control, we always work it at right angles to the prevailing wind and in long narrow strips. Under this method of operating we have been able to completely control the blowing and the shifting of the soil.

"Farmers operating in the Great Plains area where the shifting of soils gives trouble, will find that they can hold the soil in place, either where summer tillage is practiced or otherwise, if they will work it with the implements described above and in the manner herewith stated. We are finding also that the lister is a good implement with which to plow the ground where blowing gives trouble. Good results are being obtained under fall listing, the ground being gradually worked down with suitable implements as the season advances until at planting time a thoroughly firm and suitable seed bed for wheat is provided."

Listing in Sheridan County, Kansas. "If the experience acquired in producing fourteen consecutive crops stands for anything, it shows conclusively that a listed crop properly handled in Sheridan County is not a gamble, but is as certain to be profitable as any crop grown in the $100 to $200 per acre section of the country," wrote M. G. Blackman of Sheridan County, Kansas, in March, 1913.

"I have found fall listing of decided value some seasons, while in others the advantage was not so marked. Disking in the early spring before listing is good all the time. It should be remembered that a poor job of listing lasts all summer—in fact I am inclined to think it may reach over into the next season.

"The listed furrows should not be too far apart—five to the rod is just about right. At this width the middle will be well cultivated. The lister should be run as deep as it can be without throwing too much dirt over into the next furrow—always deep enough to entirely cover the ridge with fresh dirt. I have yet to see a good crop from shallow listing.

"Whenever the people of Western Kansas realize the importance of listed crops and live stock, wheat growing will become a matter of secondary importance and we will see—not a boom, but permanent good times. Then indeed the 'desert shall rejoice and blossom as the rose,'

and present land values will appear as they are, absurdly low."

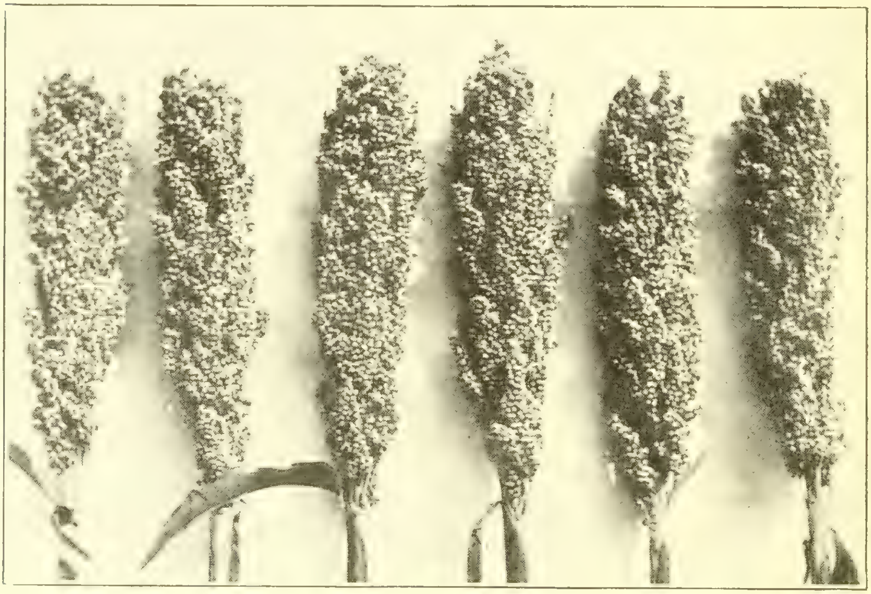
Hays Station Methods. At the Hays, Kansas, Branch Agricultural Experiment Station, Superintendent George K. Helder reports the following methods as best practice for preparing the seed bed for grain sorghums: "With cultivated land, we have found for our section that late fall listing of stubble or other cropped land, in preparation for forage planting the next spring, is a good practice. The blank listing accomplishes several results; prevents soil drift, catches the light and heavy snows and holds them on the land where the moisture is wanted, and makes a better soil condition for spring working. As early as soil can be worked in the spring, break down the listed ridges with a disk cultivator. If heavy rains come before planting time—late in April—harrow the surface to save the moisture. For planting the grain sorghums, list seed in by splitting the fall listed ridges, broken down by cultivator in early spring.

"One general practice in growing sorghums, is to disk the land in early spring, then list in the seed about last of April or early in May. We believe the fall listing for western lands is conducive to the saving of winter moisture."

Soil Blowing Prevention. Thorough cultivation is necessary for profitable crop production in the sorghum belt. But many a farmer whose fields have blown away, has doubted the advisability of stirring the soil more than is needed to cover the seed planted. It seems consistent to here insert a somewhat lengthy statement regarding soil blowing prevention methods, by E. C. Johnson, leader of farm demonstration work in Kansas:

"The Kansas Agricultural College for some years has advocated certain fundamental methods for the prevention of blowing. The more important of these are the preservation of humus by returning straw and manure to the land, using it as a surface dressing on wheat fields during the winter; increasing the humus through the

use of green manure crops such as rye preceding the summer fallow; cultivating summer fallow with shovel cultivators such as the ordinary 6 to 12-shovel corn cultivator, or the beet cultivator, or with the alfalfa renovator or other implements which leave the field in a rough instead of pulverized condition; cultivating only when the ground contains moisture, but is not wet, and giving



Fully Matured Heads of Blackhulled Kafir of 1913 Crop Grown in Central Kansas.—The Seed Was Planted Early and Was of Early Maturing Strain—Two Reasons Why it Made a Crop.

only sufficient cultivation to keep down weeds and preserve a coarse soil mulch; summer fallowing with the lister instead of plow and disk, or summer fallowing by plowing twice, once in the spring and once during the summer, leaving the field in the rough; using inter-tilled crops such as kafir, milo, other sorghums and corn, in place of so much wheat, and preparing the land by listing east and west, or at right angles to the prevailing wind, instead of by plowing. These methods have been used efficiently in preventing blowing at the Agricultural Ex-

periment Stations at Hays, Garden City, Dodge City, Tribune and Ogallah, for several years.

"The district demonstration agents in Western Kansas, thoroughly acquainted with these recommendations and methods, are emphasizing the application of one or more of these according to local conditions and have planned certain demonstrations which will show their practicability. They have therefore been making recommendations as follows:

(1) "Wherever land sown to winter wheat is likely to blow and it is possible to obtain straw or manure, scatter a thin dressing over the field during the fall and early winter and go over it with a disk set straight so that the straw and manure is pressed into the ground.

(2) "Where summer tillage is to be practiced, and it usually should be practiced where it is the farmer's purpose to plant winter wheat, plow the land after weeds have started in the spring, till it only when the ground is slightly moist or when the soil will turn over a little cloddy. Till only sufficiently to retain a coarse soil mulch and prevent weed growth, using a shovel cultivator, alfalfa renovator or other tool leaving the field in the rough; or list the land east and west after the weeds have started, splitting the ridges later and working the land down slowly to a level condition in preparation for winter wheat.

(3) "Where land is to be used for sorghums or corn, list it in the fall or in the spring as soon as the frost is out of the ground; then plant kafir, milo, other sorghums or possibly corn the last half of May. Plant with the lister either by splitting the ridges or in the lister furrow or, if ridges have been worked down gradually, plant with the loose ground lister, the disk furrow opener or the regular lister.

"Each of the three district agricultural agents in Western Kansas has secured forty or more co-operators to undertake at least one of these demonstrations. In some cases a single demonstrator has undertaken all of

them. In addition a number of the best farmers have been practicing similar methods of soil handling to some extent. The results obtained by these and by the demonstrators selected by the agents already have shown that unless conditions are extreme, excessive soil blowing may be prevented very largely by correct methods of farming, thus substantiating in actual farm tests the results obtained at the Western Kansas Agricultural Stations."

Farmers' Preparation for Milo. The methods of seed bed preparation of those Western Kansas farmers reporting their milo growing methods for Kansas Farmer, will prove valuable. To compare each method here named with the yield above mentioned, will prove interesting:

Double disk and then plant with lister same as corn.—H. C. La Tourette, Decatur County.

Disking early and then listing as the season gets warmer.—C. A. Calkins, Hamilton County.

Ground disked in spring, seed listed in with corn lister—one bushel of seed to 14 acres.—A. L. Hicks, Norton County.

Early disking, blank listing, split the ridges and plant with lister.—C. R. Henry, Cheyenne County.

Early disking, then listing.—George Shields, Sheridan County.

Fall disking followed by lister at seeding time.—Agricultural Experiment Sub-station, Ford County.

First disking and then listing.—Richard Grimes, Clark County.

Double disking before listing in rows 3.6 feet apart.—Lee McKissick, Clark County.

Blank listing.—J. W. Patterson, Stevens County.

Disking early in spring, planting with lister.—C. W. Askew, Ness County.

Disking in the spring as soon as we can get in the field, then listing early, blank listing, then when it is time to plant, listing and planting with lister.—Monroe Traver, Stevens County.

Disking before listing about May 1.—J. A. Clark, Ness County.

Disking and then listing or disking and plowing.—C. M. Jennison, Lane County.

We have tried two methods of preparing the ground. The best way is to disk the ground early and then plow. We have sometimes thought it better to pack the ground after plowing, plant with ordinary corn planter with furrow openers. It is harder to get the crop started in a lister furrow and it is also quite likely to be buried with hard showers of rain.—M. L. Brooks, Scott County.

Double disking and listing two-thirds as deep as listing corn—G. J. Stauth, Ford County.

Plow the ground and pulverize thoroughly and then list deep. I plant much on freshly broken sod.—M. C. Campbell Ranch, Clark County.

Fall Listing Pays. The experience of most Western Kansas farmers who have fall listed for spring crops, is that it pays in crop assurance. Several farmers told me, when I drove through Sherman, Thomas, Gove and Sheridan counties late in August, 1913, that the only farmers who had a crop of wheat, milo or cane that year, were those who had wheat planted on summer fallowed land and those who had milo and cane on fall listed land. I spent some time in the same section the fall of 1911, which was a year of light rainfall, and was told that almost the only feed grown in the several localities, was that spring planted on fall listing. One farmer in an extremely dry district, listed his ground in the early fall of 1910 and as there were no spring rains, he drilled the seed in the bottom of the old furrow, not re-listing or splitting the ridges as he had intended. He planted seventy acres in this way and the entire acreage produced some grain. He was the only man in the township who did not have to either sell stock or buy feed.

The advantage of such methods is to accumulate in the soil all the moisture possible in advance of planting and give the crop the advantage of more than the sea-

sonal moisture and hold the land in a ridged condition to prevent blowing.

Preparing Sod for Sorghums. There are still many farmers who desire to plant sorghums on sod. For Western Kansas planting, George K. Helder, superintendent of the Hays, Kansas, Agricultural Experiment Station, wrote Kansas Farmer: "I would suggest that the

This Norton County, Kansas, Field is Listed to Corn in Level Furrows Running Around the Slope, the Object Being to Catch and Hold All the Water that Falls.—Contour Farming Prevents Water Running Off and Soil Washing.

sod be broken in late April or early May after grass has well started. If a good, 'smooth' job of breaking is accomplished, a disk may soon be used to both cultivate the sod and also firm the soil. A planter then could plant the grain in rows, and the field would require little cultivation that season. At least six inches of timely moisture would be required to mature a good crop of forage. I have seen the planter used directly on the new breaking, without additional work with disk harrow. It sometimes brings results, but not so assured a process as using a disk."

Listing or Surface Planting. Listing is regarded as the best corn and grain sorghum planting method for the sorghum belt and has been adopted by farmers generally. However, the lister user should be impressed with the fact that thorough field preparation in advance of listing is necessary to obtain best results. Lister planting in hard, weedy ground cannot give crop assurance and yields equal to planting in land made mellow and clean by previous cultivation. Planting results are measured by the preparation given the field in advance of planting rather than by the method employed in placing the seed in the ground.

On those lands to which either listing or surface planting is adapted, the results obtained are about equal. At the Manhattan, Kansas, Agricultural Experiment Station, listing and surface planting were compared in six trials, and at the Stillwater, Oklahoma, Agricultural Experiment Station two trials were made. In five of the eight trials listing gave the higher corn yield. Averaging the eight trials, listing produced two bushels of corn more per acre. Under the conditions of these trials the results were so near equal as to warrant no claim for the superiority of one method over the other.

However, there are conditions of soil and climate under which listing is the best known planting method and may be regarded as essential for the most satisfactory results. The pages immediately preceding, which report the experiences of farmers in the handling of western lands, make it plain that west of the 98th meridian the lister is indispensable. In this area its use must be depended upon as the best means of overcoming damage to land and crops from soil blowing and also for the cheap and most expeditious preparation of a seed bed possessing a maximum of accumulated and conserved soil moisture. The upland soils of this area are light and mellow, well drained and aerated and readily become warm. These are conditions favorable to the use of the lister. The summer temperatures of this sec-

tion are generally high, the winds constant and evaporation of moisture rapid, and this combination of unfavorable crop conditions is best offset by the lister furrow, the bottom and sides of which—and even the ridges—are covered with a coarse, moisture-conserving mulch. Planting in the bottom of the furrow permits deep rooting, protects the young plant from injury by the winds,

Contour Farming on the Farm of J. M. Gilman, Leavenworth County, Kansas, and Showing Results of First Year's Work.

and catches and holds the rainfall. Yet, it must not be understood that the lister can take the place of the plow on the farms of this section. Plowing, to the extent set forth in the cultivation methods previously described, is essential and must be done in a successful rotation of crops. Plowing for wheat or other small grains, followed with fall and spring listing for grain sorghums, places the lister where it belongs in the farm practice of the belt of thirty inches or less of annual precipitation.

The lister may be generally used in that territory lying between the 98th and 96th meridians, the greater part of which is an area of thirty-five inches of precipitation. However, on the heavier bottom lands the seed bed for both corn and grain sorghums can best be prepared by plowing, with the added advantage that on such lands surface planting can usually be done a week or

ten days earlier than the lister furrow will permit. The level uplands of this area should be listed for the same reasons as given for the area farther west, except that the lister furrow is rarely needed as a means of controverting damage from blowing. Hilly lands should not be listed because of the damage done by soil washing.

East of the 96th meridian, which is an area of forty inches or more of annual precipitation and the soil of which is generally heavy, surface planting following plowing, on all lands except the level uplands, will give the best results. Plowing will give the more thorough preparation, will result in better drainage and aeration of the seed bed, the soil can be worked earlier in the spring, and surface planting will promote germination and rapid growth.

In the preparation of the field and in planting grain sorghums, those methods which will give the crop an early start are to be kept in mind, and should be adopted in all sections except those in which there are crop influencing factors which require special soil handling methods. This, not because the plants require all the days of a normal growing season, but because the sorghums give the highest degree of crop assurance when permitted to use a maximum amount of the early moisture. They resist dry weather as do no other similar crops, but it is worth while to give them opportunity to mature early and so evade dry weather. The improvers of grain sorghums have directed a large part of their attention to the development of earliness in maturity that the accumulated moisture and early rains may "make" the crop. To reap the full benefits of this work early planting is to be encouraged.

In every section there are some objections to listing. Dashing rains wash the seed out of the furrow, or bury the seed or growing plant by washing soil into the furrow. In some seasons the seed is rotted as a result of water standing in the furrow. In some sections of extremely rolling lands continued listing has washed the surface soil

from thousands of acres. These are conditions which cannot be wholly overcome. However, contour listing is helpful. Under this method the lister furrows extend across the slope and not in the direction of the slope, thus controlling soil washing to a considerable extent. Contour listing also catches the rain and snow in the furrow and holds the water until it settles into the subsoil. This latter feature commends it to the area of light rainfall.

The use of the furrow opener will become more general in heavy, low lands. In several respects it has more commendable features than has the lister. It will permit of deeper planting than ordinary surface planting and in this particular possesses practically all of the advantages of listing. If the furrow opener is to be used, the ground must be plowed, and there is no better preparation for corn or sorghums than plowing. By the use of the furrow opener the tendency of rolling lands to wash is reduced, and on low lands it will make earlier planting possible.

When to Plant. The date on which the sorghums may be safely planted for grain is governed by the season and the condition of the soil upon which they are to be planted. This date may vary a week or ten days on adjoining farms or even adjoining fields. The seed of sorghums, like that of corn, will not grow in cold and wet ground, and when planted in such ground there is danger of the seed rotting and a poor stand resulting. It may be safely said that kafir and milo can be planted in each section at such time as corn planting is well under way. Every corn grower well knows that in his neighborhood farmers differ as to whether corn planting should be done extremely early or delayed until the soil becomes thoroughly warm, and which usually means a difference of not more than a week.

Cultivation of the land early in the spring and continuing until planting time, results in the soil warming earlier than if not cultivated, and on cultivated soils sorghums can be safely planted earlier than on uncultivated soils. Some soils will permit of earlier planting than

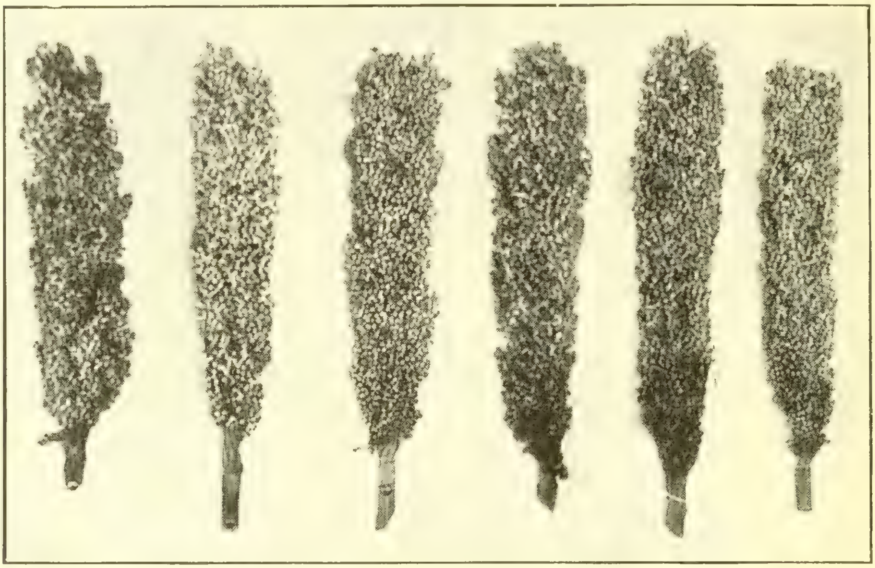
others, even though prepared similarly. Whether or not the land is free from the seed of weeds at the time of planting is also a factor. Foul land should not be planted until the weeds have started and have been destroyed by cultivation.

In my experience as a kafir grower, I have seen nothing which warrants the belief that vigorous, acclimated seed of kafir is more likely to rot in the ground than is corn. I am sure, however, that the vitality of kafir seed varies greatly, and it should be the effort of every farmer to plant well-matured seed which has had proper care from harvesting to planting time. If he has such seed he need not hesitate to depend upon it for a stand when planted at such time and under such conditions as his judgment would dictate as best in the case of corn.

If the farmer is unable to determine for himself the proper time for planting sorghums and so cannot break away from the custom of his neighborhood, then he is safe in following the general idea, namely, planting sorghums a week following the accepted date for corn planting in his locality. Reference to the map on page 122 will aid the sorghum grower in determining the safe dates for planting in Kansas to escape killing frosts. This map shows the average date of the last killing frost in the spring for the several sections of that state. If for any reason the stand of kafir or milo should not be satisfactory, the field may be replanted by drilling in the row originally planted. They may be drilled following a poor stand of corn and have ample time for maturity. It is my observation, though, that most so-called poor stands of kafir and milo should not be replanted if the crop is desired for grain. Usually, following the prevailing rate of seeding, there is a sufficient number of plants on the ground. Not infrequently have I seen a stand regarded as unsatisfactory produce the heaviest grain yield of the neighborhood.

Rate of Planting for Grain. To lay down a rule of value as to the amount of kafir, milo, feterita or cane

seed to plant per acre, is as impossible as to fix the planting date or determine the best methods of planting. I know that for satisfactory grain yields the prevailing rate of planting is much too thick. Thick planting results in small heads and decreased yields. Thin planting produces larger heads, average yields of grain and greatly increased crop assurance. Were the seasonal conditions



Three Heads on Left Typical of Field of B. V. Jackson, Greer County, Oklahoma, 1912.—Yield, 62 Bushels per Acre; Corn on Same Ground Yielded 25 Bushels; Milo, 50 Bushels.—Seed Has Been Selected Seven Years for Heavy Yielding Type.—Land Plowed 10 Inches Deep in November.—Field Averaged Three Stalks per Foot and Was Cultivated Four Times.—Heads on Right Grown by Lee Neeley, Johnson County, Oklahoma, 1912.—Yield 122 Bushels per Acre.—Land and Crop Measured by Agent Federal Department of Agriculture.—These are Typical High Yielding Heads.

such as to insure sufficient moisture for the maturing of a medium-sized head on each stalk in a thick stand, then thick planting would be most desirable. There will be seasons when the yield would have been heavier as a result of thicker planting and the farmer may be disappointed the first year he plants thin, but the consistent thin planter will in a ten-year period have produced much

more grain per acre than his neighbor who plants thicker.

The thick planting of grain sorghums is due to two principal causes: (1) the desire to grow both a grain and forage crop from the same planting, and (2) because to date there is no machinery which will plant the seed of the sorghums at the proper rate. The most consistent grain yields will come from a stand planted for seed. A far better quality of forage will be obtained from planting specially for forage. Two plantings, each for its purpose, give greater crop assurance, can be harvested and fed more cheaply and with greater profit than a crop grown for the two purposes.

For either grain or forage the rate of planting will vary with the different sections and will be governed by the probable rainfall during the growing season, the moisture present in the soil at planting time, and also upon the degree to which the farmer will be able to conserve moisture by thorough cultivation. To attempt to grow more plants than the soil moisture will mature, is foolhardy. To plant as thick in the area of twenty inches of annual precipitation as in the area of forty inches, is a reckless waste of labor and a sacrifice of opportunity on the part of the western grower.

Every farmer who grows corn and sorghums has noted the large ears and heads which grow on the turning row. There the stand is usually the thinnest and the stalks obtain moisture from a larger soil area. Likewise, most farmers have obtained fair yields of corn and grain sorghums in a dry year from accidentally thin planted fields. Every year, in every community, the reader has observed instances of crop failure through too thick planting. In 1913 in every county in Kansas thin planted fields of kafir and milo yielded fair grain crops, while thicker planted fields failed totally. Almost every field of feterita in Kansas matured grain in that year. In every instance of the many I have investigated, the stand of feterita was much thinner than adjoining stands of kafir or milo. Thin stands no doubt contributed largely to the

success of that crop in that year. This same condition was true of corn, that planted thin making a crop, while that planted thick failed to mature grain. The growing season of 1913 was a rare exception in its severity, but the best corn growers have come to realize that much thinner planting than formerly is resulting in the highest yield of shelled corn year after year. It is for the farmer to learn the most profitable rate of planting for the crops he grows. He can be helped in this only by suggestion, for the same reason that there can be no ready-made, never-failing rule for successful farming.

These figures are offered in evidence of the statement that thinner planting may be practiced without seriously affecting the average acre yields:

In an acre of check-rowed corn there are about 3,500 hills. If in each hill there were one stalk and that produced a pound ear—which is not a large ear of corn—the yield would be 50 bushels, or nearly three times the Kansas average. Most corn growers plant three kernels in a hill, or, if drilled, about five kernels to each three and a half feet of row. It is safe to say that there are few farmers in Kansas in the area of less than thirty-five inches of annual precipitation—aside from those who farm the best bottom lands—whose average is even near fifty bushels per acre for a ten-year period. Even six-ounce ears are not produced on one-half the corn stalks grown on the best corn lands. What's the reason? One is—too thick planting and insufficient moisture for all the stalks. The chances for getting a fair-sized ear on each stalk of thin planted corn are manifestly better than the chances for a nubbin on each stalk when five stalks divide the moisture needed by a single stalk.

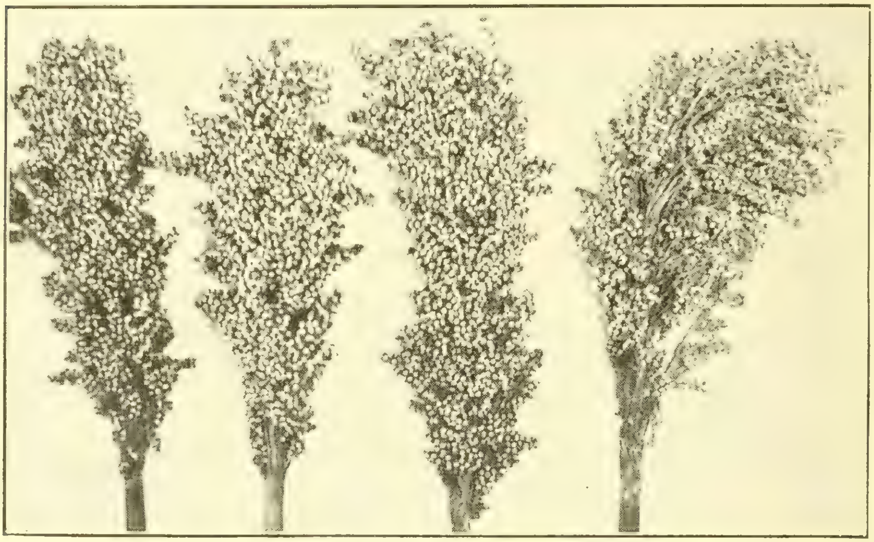
If one seed of kafir were planted to each ten inches of row, and each seed grew, there would be slightly in excess of 14,000 kafir stalks per acre, the rows being three and one-half feet apart. If each plant should produce a four-ounce head, the yield would be fifty bushels

per acre, figuring seventy pounds of kafir heads as a bushel. This yield would also be far in excess of the state's average. Every stalk of kafir will produce a head if given a chance. It is well for the farmer to begin to realize that two heads of kafir, milo or feterita are the near equal in feeding value of an ear of corn, and that to produce two of these where an ear of corn should grow is a good rule to follow. Under average field conditions kafir heads weigh four to six ounces and milo heads three to four ounces, as reported by Carleton Ball, agronomist for the Federal Department of Agriculture. I have kafir heads of the 1913 Kansas crop weighing three and a half to six ounces, milo heads weighing six to seven ounces, and feterita heads weighing three to three and a half ounces.

To be sure, these are theoretical stands for both corn and kafir. No man can plant one grain of corn or kafir in a hill, and if that were possible he would not have a stalk in each hill. When the farmer of the sorghum belt realizes that moisture to mature his crops is the controlling factor, he will understand the futility of using it in growing more stalks than can produce grain. Fewer plants, both in the case of corn, kafir and other grain sorghums, will greatly increase crop assurance, and this should be sufficient reason to warrant thinner planting.

Kafir growers generally do not appreciate how thick they do plant. On this point these figures will prove instructive: In a pound of cleaned and graded seed, from which the cracked and small seeds have been removed, there are 22,000 to 24,000 seeds. Planting seeds four inches apart in the row would require 37,200 seeds per acre; eight inches apart, 18,600 seeds; ten inches apart, 14,500; twelve inches apart, 12,400; and sixteen inches apart, 9,300; and such rate of planting would result in about the same number of stalks per acre. It will be noted that the four-inch planting will require only slightly more than one and one-half pounds of seed per acre, and ten-inch planting would require little more than a half

pound. A quart of kafir seed weighs one and three-fourths pounds and so has 38,500 to 42,000 seeds. The prevailing rate of planting for grain in Kansas varies from two quarts or three and a half pounds to one gallon or seven pounds of seed per acre. From the above the farmer may be able to determine the number of stalks per acre he is likely to have from the seed he plants.



Heads of Mongrel Kafir Showing the Result of Mixing with Cane and Broomcorn.—Such Heads are Typical of Low Yielding and Late Maturing Fields.

Rate of Planting Trials. Trials to determine the most desirable rates of planting grain sorghums have been made in considerable numbers at the forage crops stations of the Federal Department of Agriculture in Texas.

Four years' tests at Amarillo indicate that the planting of milo seven or eight inches apart in the row, and kafir nine to ten inches, in rows three and one-half feet apart, gave better yields than other rates of planting. The average annual precipitation at Amarillo is 22 inches.

At Chillicothe, Texas, the heaviest yield of kafir in 1912 was obtained when the seeds were planted six to eight inches apart in the row, while the heaviest yields

of milo were obtained when planted eight to ten inches apart. The 1912 precipitation at this station was twenty inches, which was two inches less than the average for a seven-year period.

White milo six to ten inches apart in the row, gave 42 bushels of seed per acre at the Lubbock, Texas, Agricultural Station. The total precipitation for the season at this station was 14.16 inches. These trials give the reader an idea of yields obtained from thin stands and in which the comparatively few plants had opportunity for fullest development.

H. M. Bainer, agricultural demonstrator for the Santa Fe in Texas, New Mexico and Colorado, says: "Kafir under Texas Panhandle and Plains conditions, should be thinned to 24 to 30 inches in the row, and milo, feterita and broomcorn to 18 to 24 inches in the row."

Feterita Planting and Stands. Here are the stands reported by farmers who grew feterita in Kansas in 1913 and the yields of which varied from 25 to 55 bushels per acre:

Stalks from 8 to 12 inches.—Martin H. Anderson, Crawford County.

Very uneven—from 2 to 3 feet in drill.—J. J. Reinhardt, Johnson County.

About 6 inches.—J. C. Hastings, Jefferson County.

About 4 inches apart.—J. H. Heller, Shawnee County.

Planted 12 to 14 inches in row.—H. B. King, Labette County.

About one grain to the hill and 20 inches apart.—R. M. Taylor, Osborne County.

About a foot apart.—Dan McIntosh, Rawlins County.

Planted one grain to the hill and 16 inches apart, but it did not stand that thick on the ground.—William Marquard, Barber County.

Ten inches apart.—George L. Bishop, Washita County, Oklahoma.

Milo Stand in 1913. P. S. Houston, the Thomas County banker, who in 1913 grew 5,000 bushels of milo

in a 200-acre field, planted the hills 18 to 20 inches apart and two to three seeds in a hill. "Two seeds in a hill is sufficient if the seeds are good; the yield and quality will be better if the stand is thin than if too thick," says Mr. Houston. "I cannot obtain a satisfactory rate of planting with plates furnished with the lister. They plant too thick for this western country. I buy blank plates and have them drilled to conform to my own ideas as to stand."

Plants Kafir Thin. A Jewell County, Kansas, grower who for years has made a specialty of kafir growing, wrote Kansas Farmer: "Two pounds of kafir seed will plant an acre, making one grain every five and one-half inches, which makes the stand plenty thick. I take extra precaution to see that the seed is perfectly clean and free from chaff and weeds and that the seed has a high germination test. The kafir I planted this year germinated 90 per cent."

Planting Machinery Not Adapted. I have talked with many farmers regarding the thinner planting of grain sorghums and almost invariably they agree that the prevailing rate is much too thick. It is easy to advise that three-fourths pound of good seed per acre should be planted in the area of thirty inches of precipitation, and that at such rate stalks will grow eight inches apart in the row, and that a half pound planted in the area of twenty-four to thirty inches precipitation will give a stalk each twelve inches, but how to accomplish this thin planting is the important question. Much of the influence of the recommendation is lost when the farmer understands that for the present he can obtain such stands only as a result of hand-planting or thinning. The stands obtained at the Texas forage crops stations as above described were hand- thinned. The sorghum grower feels that he cannot do this hand work, or at any rate will not, but it is my opinion that he can well afford to thin a thick stand. This can be done expeditiously with a hoe and I doubt if the sorghum-growing farmer could better

spend an equal amount of time. So to do would greatly increase his assurance of a crop, and that is the important sorghum belt consideration.

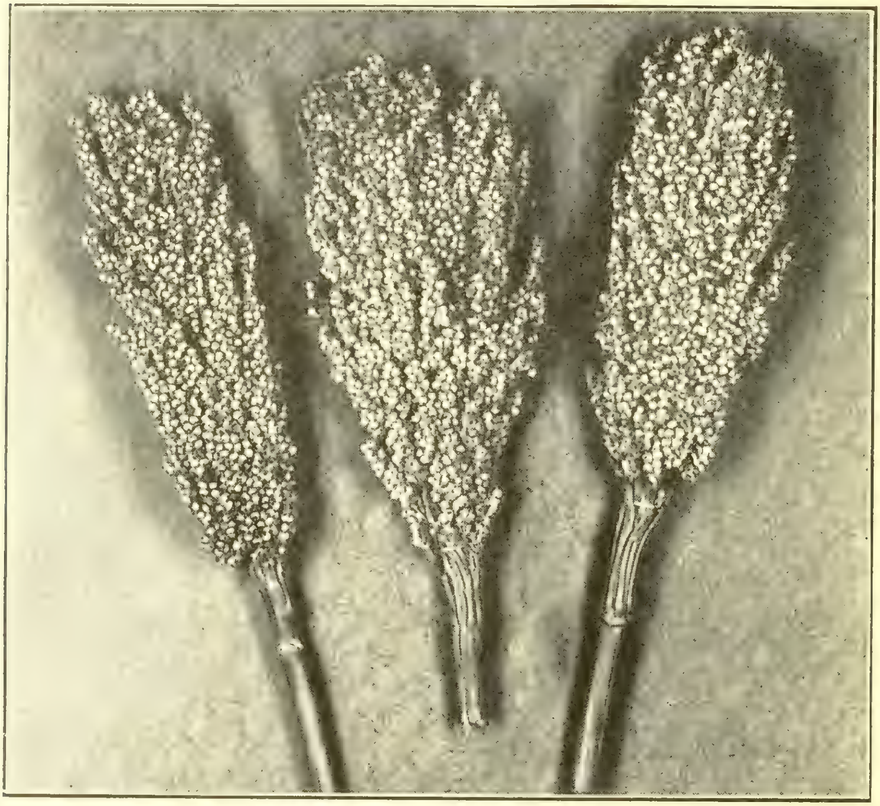
The writer has for some months been interested with other individuals in an effort to get manufacturers to devise a grain sorghum planter. The International Harvester Company and John Deere Plow Company have been working on plates for drills to accomplish thin and uniform drilling. Success has not yet crowned their efforts. It would seem that a different dropping principle than that now in use must be employed.

A test was made of one of the standard listers, using the sorghum-dropping plate sold with the machine. Set at the slowest speed, this plate dropped an average of fifteen kafir seeds per foot of row, and at this rate eight and one-half pounds seed per acre. The number of seeds dropped per hole in the plate varied from four to eight, while a sufficiently thick stand would have been secured by dropping one seed for every other hole, provided every seed grew. The plate was one-fourth inch thick and the holes were one-fourth inch in diameter.

The thickness of the ordinary dropping plate is sufficient to hold two layers of seeds, one above the other, and an attempt has been made to correct this defect by making plates so thin as to allow only one layer of seed in the hole. The thin plates have been found to wear out quickly and also to form a shearing arrangement that grinds many of the larger and best seeds. Holes have been made smaller in diameter to prevent them holding so many seeds. Seeds will frequently become wedged together in the small holes and not drop out for a considerable time, causing many vacant spaces in the row. Several farmers have reported fair success by plugging up every other hole in the dropping plate with lead or babbit. A few farmers have reported that in addition to plugging half the holes, they have put a wire loop in the spout below the plate, adjusting it until it scatters

the seeds along the row when more than one are dropped at a time.

The thin planting of milo and feterita will not be so difficult because the seeds are larger and so fewer seeds



Heads of Kafir Grown in 1913 at Eads, Colorado.—Field Yielded 25 Bushels per Acre.—Matured in 100 Days with Only Three Light Showers.—Planted on Fall Listed Land.

pass the openings. I talked with a farmer who planted kafir in 1913 with a garden drill. He enlarged the seed container and hitched a horse to the drill. His stand averaged a stalk to each ten or twelve inches and he harvested a forty-bushel crop. Another farmer who secured a small quantity of feterita seed for 1913 planting was desirous of planting thin and making the seed go as far as he could. He plugged every other hole in the kafir

plate of his lister and the stand averaged one stalk to each twenty inches, although this same plate dropped three to five seeds of kafir in the same furrow space. Undoubtedly machinery thoroughly adapted to sorghum planting will in the near future be invented. In the meantime the farmer should do his best to get as near as possible the desired results from present machinery.

I would try out the several rates of planting by hand-dropping. By such means I would make several tests. If I found that thinner planting than the drill would do, was necessary, I would drop by hand until machinery could be devised to do the work. I have dropped acres of corn by hand and could as well drop kafir, milo or feterita. Possibly it would be less laborious to plant as thin as the planter would drop and then thin the stand with a hoe. I have done this job, too. It is certain that when the whole season's work depends upon a crop—which if too thick is likely to result in total failure—the grower can afford to resort to extraordinary means to secure crop assurance.

Cottrell's Planting Advice. The discussion of this subject could not close with better suggestions than those of H. M. Cottrell, who has for two years closely studied the rate of planting grain sorghums. He says:

"Getting an even stand with the plants at the proper distance to secure sufficient moisture for the maturing of a good yield, is the difficult problem in raising the grain sorghums. It is difficult to secure, on account of the faulty construction of the planting devices, the quality of the seed and the condition of the land. In Central Kansas and Oklahoma, one good stalk every eight inches will usually produce the best yields. In districts of more rainfall, the highest yields are sometimes secured with stalks six inches apart in the row. In Western Kansas and Oklahoma the stalks must be twelve to sixteen inches apart, depending on the rainfall and character of soil. On tight land the stalks must be farther apart than on sandy soils, and more space between stalks is required

on upland than on bottom lands in the same neighborhood. Another factor is the varying carelessness in covering up the young plants during the first cultivation.

"The best advice that I can offer is to use about three pounds of well cleaned and graded seed per acre in districts of thirty inches average rainfall a year, and about two pounds per acre where the precipitation is less. I would not use seed that showed poor germination, even if I had to hand pick all the seed planted and pick out the stained grains and those that appeared damaged."

Seed Quality Important. It should be remembered that the amount of seed planted per acre must be governed by the quality of the seed planted. If only half the seeds will germinate, then it will require twice as much seed per acre to obtain the desired stand as if 95 per cent of the seeds planted should germinate. If mature heads are gathered in the field in the fall and these heads are kept dry, 90 to 95 per cent or more of the seeds will germinate. This is the only way to select and hold seed from year to year. In order to control the stand by accurate planting, clean seed of good quality only should be planted.

Thick planting in a dry year will result in a total failure of grain. A thin stand will produce an excellent yield of grain in a wet season, a good yield in a normal season, and a fair yield in a dry season. It is manifestly more profitable to obtain a fair yield season after season, including the dry years, than a high yield in a wet season and no grain at all in a very dry season.

Planting Dates and Yields at Chillicothe. At the Chillicothe, Texas, forage crops station the Federal Department of Agriculture has made numerous trials during four seasons to determine the relation of planting date to yield of kafir and milo. The average annual precipitation at this station is twenty-three inches. The soil is a reddish sandy loam and bakes hard following rains.

Kafir planted April 15 averaged 34 bushels per acre;

planted May 1, 28 bushels; May 15, 23 bushels. Each planting fifteen days later and continuing to July 1, showed a gradually decreasing yield. Milo gave the highest yield when planted May 1, being 32 bushels compared with 23 bushels when planted June 1.

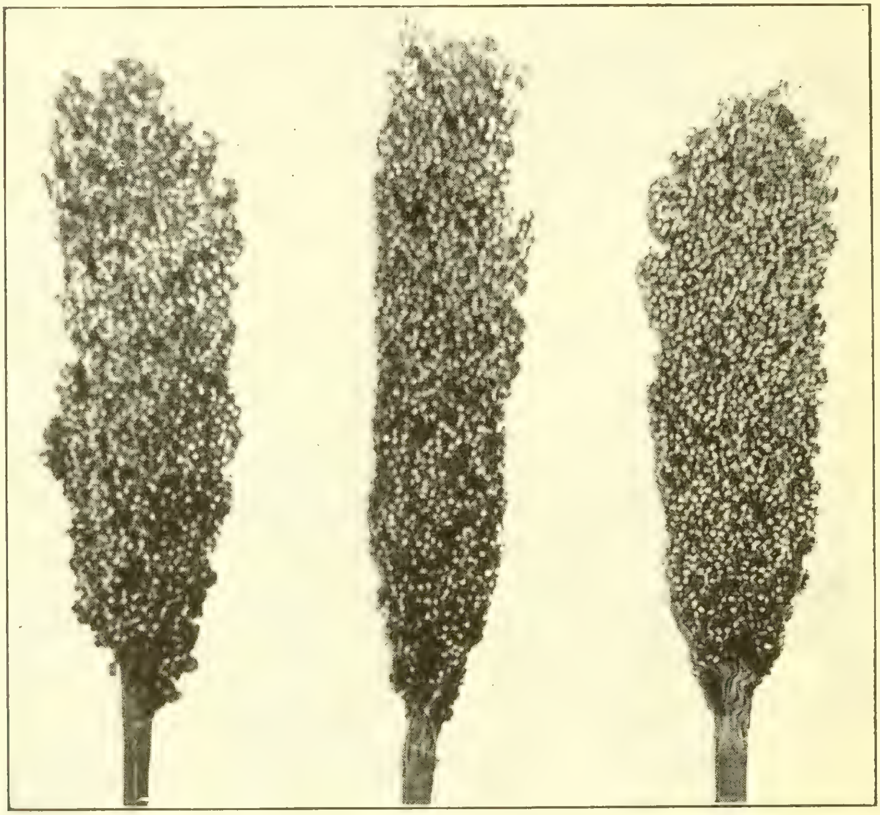
The year 1909 was severely dry at this station and in that year milo planted April 15 yielded 15 bushels as against seven bushels for that planted May 15. In this season kafir planted May 15 matured only scattering heads and later plantings produced no grain.

These tests indicate that milo—and in all probability, feterita—gives best yields when planted fifteen days later than kafir.

Planting for Forage. For forage, the amount of seed planted should be governed by the amount of moisture in the ground at planting time and the rainfall during the growing season. A forage crop is not expected to produce much grain and the stalks should stand thick enough on the ground to produce fine—not coarse—forage. For forage, a large proportion of leaf to stalk is desirable, and this is obtained by thicker planting than when a crop of grain is desired. Thick planting has resulted in more disappointment in yields of forage than any other cause. Thousands upon thousands of acres of cane and kafir fail every year because the crop literally burns up—because there were two or three times more stalks on the ground than the moisture could support. The drilling of a bushel or more of cane or kafir in Western Kansas is disastrous for every year except the unusually wet. The seeding of one and a half to two bushels on the uplands of Eastern Kansas will result in greatly diminishing the crop certainty every year. Since at seeding time no man is able to know what the season's rainfall will be, it is a good policy to safeguard against the dry year and at the same time adopt such planting methods as will give the desired forage quality. To accomplish this, the grower should arrive at a happy

medium in the planting rate and use such planting method as is likely to give the surest crop.

The planting of kafir and cane in rows, for forage, is to be recommended, and applies to the areas of heavy as well as light rainfall. Row planting is necessary for the



Kafir Heads Grown 1912 by Stephen Goble, Greer County, Oklahoma.—Yield, 71 Bushels per Acre.—Heavy True to Type Heads Had Been Selected by Him for Seed for Years.

sections of light rainfall that the crop may be planted sufficiently thin and cultivated. For the areas of heavier rainfall—30 to 35 inches—it is recommended because the seed may be planted plenty thick in the row to make fine forage and yet prevent the use of so much seed that a deficiency of moisture will result in crop loss, and also that in a season of short rainfall the crop can be culti-

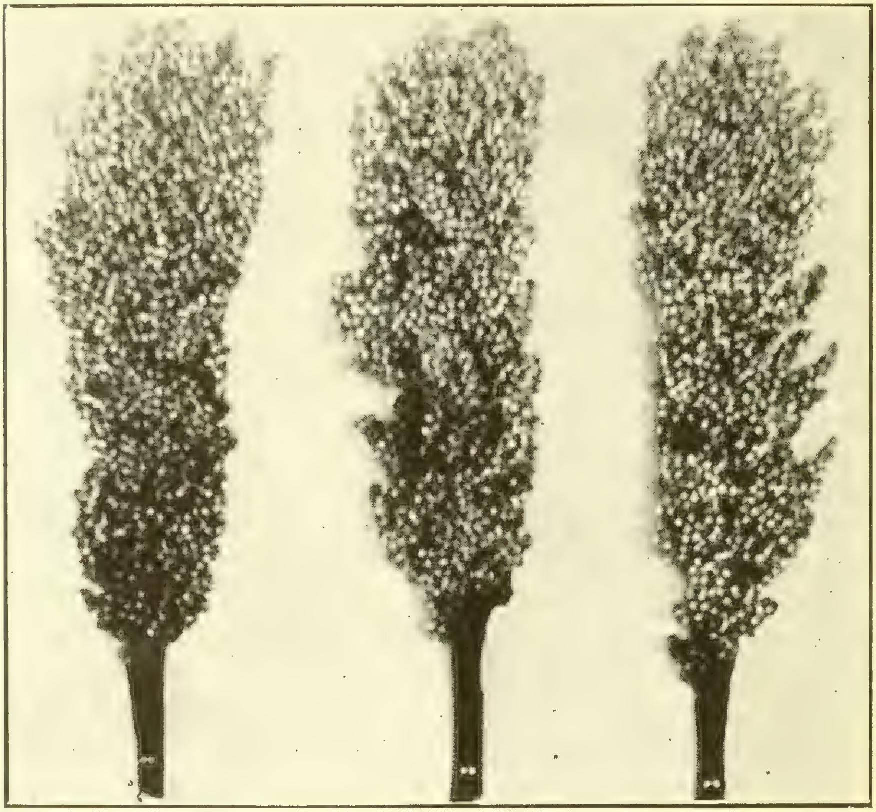
vated, the moisture conserved and the crop forced to satisfactory growth. In the areas of heavier rainfall the row-planted crop may not in a wet season produce so large a tonnage as if drilled, but this decreased yield is more than offset by the assurance of a satisfactory yield in a drier season. After a few trials the grower of sorghum forage will see the advantages of row planting when viewed from the standpoint of growing fine—not coarse—forage, and the greater assurance of a crop in a dry year. It sometimes happens that the first planting is destroyed by dry weather or chinch bugs, or both, and it is necessary to plant again in July or later. Under such conditions row planting applies to the need of every section, whether of light or heavy rainfall.

For sections of light rainfall the rows should not be closer than three and one-half feet and enough seed planted in the row to prevent coarse, heavy stalks. I know Western Kansas and Eastern Colorado growers who leave each third row blank, thus giving each of the growing rows the moisture from an extra three and one-half feet of ground, and the plan works well, especially if the grower has had difficulty in reducing the amount of seed drilled in the row to the amount he considers desirable. For the areas of heavier rainfall—30 to 35 inches—the rows may be drilled closer than in corn planting and more seed placed on the ground, but still giving all the advantages of the row planting method.

Row planting will permit harvesting with a wheat or corn binder, either for the silo or shocking in the field, and this is the cheapest, most expeditious and satisfactory manner of handling. When the forage is placed in bundles it can be shocked and delivered to the feed lot with ease compared with other successful ways of handling.

Early Planting to Utilize Early Rainfall. My insistence upon early planting is based upon the utilization of the accumulated moisture of the winter and the rainfall of the early growing season. Early planting will permit the use of a maximum of such moisture at a time

when other conditions are also favorable to the growing crop. Every farmer sows oats early that the crop may have the benefit of the early moisture and that it may mature in advance of the unfavorable latter part of the season. Corn is planted as early as is possible for the



Type of Head Typical of 1912 Field of Orrin McNath, Greer County, Oklahoma.—Yield, 124.8 Bushels per Acre.—Measured by Agent Federal Department of Agriculture.

same reason. While the sorghums are more dry weather-resistant—less affected by dry weather and high temperatures—than corn or oats, nevertheless there are the same reasons for early planting.

On page 60 it is shown that earliness in maturity and dwarfness are important essentials to the most certain and highest yields of kafir and milo because the early

maturing plants are able to make a maximum use of the early moisture and the crop is near "made" in advance of the period of decreasing rainfall and increased moisture evaporation. With early maturity as the basis of a large part of the work done in increasing the usefulness of grain sorghums in those areas in which they are so much needed, it seems unwise, and in fact foolish, to ignore the foundation of grain sorghum improvement by late planting and by the use of late maturing and indifferent seed. There is no good reason why the grain sorghum grower should fail to take advantage of and intensify and perpetuate the good work others have done for him.

A greater appreciation of early planting may be had by a consideration of seasonal conditions. The table below is compiled from the records of the U. S. Weather Bureau, Topeka, for Kansas, for the period 1886–1912. It shows the average total annual precipitation for each of the three divisions of the state, as made on the map on page 122, and also shows the inches and percentages for the several periods:

	Eastern Division	Central Division	Western Division	State
Average total inches for year	35.38	26.53	19.34	27.87
Inches, April–September, inclusive	25.07	19.84	15.13	20.50
Per cent total, April–September, inc.	70.9	74.7	78.2	73.5
Inches, April–July, inclusive	17.44	13.94	10.99	14.47
Per cent total, April–July, inclusive	49.3	52.5	56.8	51.9
Inches, August–September, inclusive	7.63	5.90	4.14	6.03
Per cent total, August–September, inc.	21.6	22.2	21.4	21.6

It will be seen from the table that 70 to 80 per cent of

the total precipitation occurs during April to September, inclusive, and of the total, 49 to 57 per cent comes during the months of April to July, inclusive. Of the July rainfall more than half falls during the first half of the month. It is worthy of note that of the growing season rainfall more than half falls during April, May, June and the first half of July. During these months other growing conditions are more favorable—the temperatures are not so high and the evaporation of the soil moisture is not so great as during the last half of July and the months of August and September. Therefore, early planting of seed of high quality in a thoroughly prepared seed bed and thorough cultivation during the early season are conducive to the near "making" of the crop in advance of the more severe and trying conditions of the latter growing period. The aim of every sorghum grower should be to get the crop "made" before the drier period, or so far along that it will be sure of maturity in spite of unfavorable growing weather, in preference to allowing it to be at a standstill during July and August and waiting for the cooler weather and rains of September.

While the figures given are for Kansas only, this distribution of precipitation prevails in those sections of Oklahoma and Texas lying south of Kansas. In Western Texas and Eastern New Mexico the period of heaviest rainfall is about a month later, but the altitude of these sections will necessarily delay planting longer than farther east. The early-maturing strains of all sorghums will have ample time, if planted early and properly cultivated, to near "make" grain by July 15 or 20. While the sorghum belt farmer is growing dry weather-resisting crops he should capitalize those sorghum characteristics which accomplish, to a great extent, dry weather evasion.

It will be a matter of interest to the reader to note the average precipitation in inches, by months, for the period 1886–1912, for Kansas, as shown by the table below and

which figures were also obtained from the U. S. Weather Bureau, Topeka:

	Eastern Division	Central Division	Western Division	State
January	1.13	.63	.37	.75
February	1.63	1.08	.74	1.19
March	2.23	1.21	.77	1.48
April	3.04	2.23	2.15	2.50
May	5.17	4.00	2.59	4.06
June	4.95	4.22	3.08	4.19
July	4.28	3.49	3.17	3.72
August	3.95	3.27	2.47	3.28
September	3.68	2.63	1.67	2.75
October	2.46	2.00	1.18	1.93
November	1.60	1.01	.67	1.15
December	1.26	.76	.48	.87
Average total inches	35.38	26.53	19.34	27.87
Inches Apr.-Sept. inc.	25.07	19.84	15.13	20.50
Inches Oct.-Mch. inc.	10.31	6.69	4.21	7.37

The extent to which precipitation decreases beginning with July and continuing to March, is worthy of note. The maximum is reached in the eastern division of Kansas in May and in the central and western divisions in June. This table will show the reader the inches of precipitation exclusive of the growing season and give him a hint as to the amount of moisture he can conserve by proper handling of soil during the months September to April and during which time none except winter crops are growing.

The tables above come near revealing all the reasons for the adaptability of the grain sorghums to the sorghum belt and why the various methods of grain sorghum growing herein discussed seem of reasonable foundation.

Bishop on Early Planting for Oklahoma. That I have the support of at least one grain sorghum grower and all-around good farmer in the cause of early planting of kafir, milo and feterita, is to me gratifying. George

Bishop, of Washita County, Oklahoma, argues for early planting from the standpoint of utilization of the early seasonal moisture. I did not know his thought on the subject until the receipt of the Oklahoma Farm Journal of April 1, 1914, which came after the preceding material had been put in type. I am pleased that the mechanical status of this book was such that a considerable part of Bishop's article could be here printed. He writes:

"The value of early planting for the grain sorghums can be determined only by a comparison of yields for a period of years. Other things being equal, available moisture is absolutely the controlling factor in crop production west of the thirty-inch rainfall line, which is practically indicated by meridian 98.

"The available moisture of which I speak means, for the average farmer, just what rainfall comes from the time the crop is planted until it is matured or makes a failure. I say this because when you go down a section line and look to the right and to the left for a ten-mile drive, you find but a small percentage of farmers who make any systematic effort to retain moisture in the soil between crops or even at the time of preparing ground for planting. This being the condition under which most crops are planted, there is all the more reason for making an effort to get that crop into the ground at a time when there is a greater number of chances for the natural distribution of the rainfall to give its greatest portion during the growing period of the crop. In spite of all the seeming irregularity of western rainfall, the records for a period of thirty or forty years show a regularity of distribution, which, if relied upon and followed as a fixed practice, I believe will bring a higher average yield and fewer failures.

"Beginning at El Reno, Canadian County, Central Oklahoma, right on meridian 98, we find an average rainfall for thirty years of a fraction over thirty inches. Of this amount, 14.88 inches fall in the months of April, May, June, and July. That is, this is the average

combined rainfall for these months for thirty years. At Fort Sill, Comanche County, Central Oklahoma, a little west of meridian 98, the average for forty years shows the months of April, May, June, and July to bring 14.84 inches of the thirty-inch annual average for that locality. Go on west to Mangum, Greer County, Western Oklahoma, with an average annual rainfall of a little over 26 inches, and the records for twenty years show that 15 of the 26 inches fall in the months of April, May, June and July.

"When the average for this length of time shows this proportion for these four months, and when the records show that of the rainfall of July, rains come more often in the first part of the month than in the latter part, it is evident that in the majority of years at least one of the greatest insurances the farmer can give any cultivated crop is to get it started in time to get as much of the benefit of the rainfall of these four months as is possible to give it. This means early planting; just as early as your experience on your farm with its kind of soil will assure a good stand.

"I believe April 15 ought to see most of the kafir planted over Southwestern Oklahoma. I know we sometimes have some very cold rains in April. It is bad for corn in the ground and worse for kafir or milo, but it is worth risking. It is my plan to plant kafir on tight upland in West-Central Oklahoma as soon after April 15 as I can get to it, if weather conditions are not such that it would be foolish to put the seed in the ground.

"It should not be necessary to say that the division of rainfall indicated here is not expected to occur every year, for we know that it will not. The year of 1911 is a very striking example to the contrary. But that it will hit more times than it will miss is evident because the records for forty years would not show this division if it had not done so in the past.

"As you go farther west into the Texas Panhandle, the proportion seems to drop back a month. At Amarillo,

with an average annual rainfall of 21 inches, the months of May, June, July and August bring an average of 12.49 inches. This higher altitude calls for later planting, of course, but the same effort should be made to get as much of the growth of these kafir crops as can possibly be secured out of the moisture for these four months."

Cultivation of Sorghums. Generally speaking, the grain sorghums have not to this date had a fair chance to demonstrate their usefulness. This is so, principally because of late planting in an indifferently prepared seed bed and poor cultivation of the growing crop. On many farms the sorghums are not planted until all other spring planting is done and the first lull comes in spring work, frequently resulting in no cultivation in advance of wheat harvest, and when so long delayed, the crop is either not worked at all or gets its cultivation so late that the object of cultivation, further than the destruction of weeds, is not accomplished. Kafir is especially neglected on farms growing corn and on many of which farms it is grown only because there remains unplanted a piece of land too thin or too weedy for corn. Yet, to some extent on such farms dependence is placed in kafir because of the fear that corn may fail. Thousands of times have I heard this remark: "If the corn fails maybe the kafir will make something." The grain sorghums, and particularly kafir, have had to fight their way to the front under just such handicap. Good cultivation for corn is good for the sorghums but no less cultivation than is given corn will discharge the grower's obligation.

Early Harrowing is Good. The sorghums should be planted in ground so clean that the cultivation need not be an all summer's fight on weeds. Their slow early growth in a cold, wet spring makes it difficult to clean the field and the crop often succumbs to weeds. Early cultivation is important to destroy weeds and also to conserve moisture. I know kafir growers who harrow the listed field two or three times before the plants are through the ground. This, to maintain the soil mulch

necessary to prevent moisture evaporation and to kill the weeds while small. The harrow teeth should be slanted backward and at such angle as to break the crust by cutting through it, rather than by digging, as is the case when the teeth are set perpendicularly. Harrowing rolls loose dirt on the listed furrow sides and this promotes moisture conservation. If the field is reasonably smooth—not cloddy—and is not covered with trash, the harrow will do no damage by throwing dirt into the furrow bottom on top of the young plants, or should the plants not be through the soil it will not cover the seeds too deep. In a clean, well prepared field, the harrow is a good cultivator and may be used advantageously until the growing crop is so large that the stalks break under it.

If the listed furrow has become so crusted, as a result of dashing rains, that the plants cannot break through, this method described by H. M. Bainer, agricultural demonstrator for the Santa Fe Railroad, is recommended: "A wooden trough through which large spikes have been driven from the inside, will prove an excellent implement for the breaking of the crust. These spiked troughs may be so arranged as to drag three or four rows at one time, and may be used in connection with the harrow for the first two or three cultivations with good results." This method of working the surface of the furrow will delay evaporation, save soil moisture and destroy weeds just starting.

Cultivation Before the Plants Are Up. If the crop has been listed in foul ground and cultivation is needed to destroy weeds on the furrow sides, this may be done when the plants are too small to cultivate or even before they are through the ground. I have cultivated many acres of listed kafir and corn and cleaned the field from weeds before the plants could be seen. This was done with a home-made implement quite generally used twenty years ago and which was commonly called a "nigger starver." It was a sled made of two-by-six planks

and sufficiently narrow to follow the listed row without crowding the furrow sides. On each side of the sled were two knives sloping backward and upward, the upward slant corresponding to the slope of the furrow side. The front knife was about eight inches long, the rear knife fourteen inches. These knives cut under the surface, destroying the weeds on the side of the furrow and causing little dirt to fall in the center of the furrow on the planted seed. When desirable to have this implement cut deep, as in the case of large weeds, the operator rode; when shallow cutting was desired, the operator walked. If the knives are kept sharp, and which can be accomplished by filing, this method of cultivation will prove effective in weed destruction and may be successfully done before the young plant shows itself or while it is small. For work at this stage of the crop's growth, the "nigger starver" is better adapted than the disk implements which in recent years have taken its place, but which are superior from the standpoint of working the dirt into the furrow and around the plant. The use of the harrow, the spiked trough and the "nigger starver" will well take care of the plant unitl it is large enough to permit deeper stirring of the soil.

Give Deep Cultivation Early. Unless the crop has been listed in hard, unprepared ground there is no need for deep cultivation of grain sorghums. The necessity for deep cultivation should have been disposed of before the crop was planted, by thorough preparation of the field. But, if the listed ridges were not broken out to at least the depth of plowing, the two feet of ground between the rows should be cultivated to a good depth that the soil may take up the rains and permit the moisture to sink to as great depths as possible, also that the roots may easily extend into the space between the rows and bring food to the plant from as large area as possible. This cultivation should be done by the time the plant is sixteen to eighteen inches high and before its roots have grown so far to the side as to be injured by deep

cultivation. This work can best be done with the common four-shovel, two-horse, one-row corn cultivator.

Later Cultivations Should be Shallow. The subsequent cultivations should be frequent but not so deep as to tear the tiny roots which fill the soil in all directions from the plant. In a wet season the small roots will be found nearer the surface than in a dry season. So, in a wet season, the later cultivation should be more shallow than in a dry season. In a dry year or in a section of light rainfall, three-inch cultivation will conserve moisture more effectively than will more shallow working. There is another condition, however, which should not be overlooked. In case the moisture is principally in the top soil, then the cultivation should be as shallow as possible. This is an unusual condition following a dry winter and spring in which the precipitation has not been sufficient to reach the subsoil. There is no advantage in "laying by" sorghum crops with the row ridged. It is just as well to save the time and horse flesh so expended. After the soil has been worked into the lister row the cultivation should be level.

The two-horse riding cultivator with six shovels—three on each beam—is an ideal implement for cultivation until the crop is too large for its use. Then the six or eight-shovel walking cultivator, spread to cover the entire space between the rows, is the ideal implement and it will pay to keep this running. The drier the season the more frequent should be the shallow cultivation.

Large weeds which have escaped the cultivator should be cut or pulled. One large weed will rob several grain sorghum stalks of the moisture needed to produce a head of grain on each. A crop of grain sorghums and of weeds can rarely be successfully grown in the same field.

Butler County Farmer's Method. A successful kafir grower of Butler County, Kansas, wrote Kansas Farmer: "I use a one-row disk cultivator to break out the lister ridges, although in advance of listing, the ground in which I plant kafir is as well prepared as thorough and

frequent disking will accomplish. I follow the disk cultivator with the common six-shovel corn cultivator. I work as long as possible, and at least two weeks later than corn. Shallow cultivation is essential, because the root system of the kafir plant is extended the full distance between the rows. The roots reach out for moisture in all directions. For breaking the crust between the rows after a hard rain I use a harrow with slanted teeth and which is not permitted to cut deep enough to injure the tiny roots. With the proper care heavy yields are easily obtained in this section, and while the kafir crop may be a little harder to handle than corn, it brings in rich returns from land that will not yield corn in paying quantities and under conditions where corn is a total failure."

Late Cultivation at Hays. G. C. Wheeler, associate editor of Kansas Farmer, writes of an experience at the Hays, Kansas, Agricultural Experiment Station, while he was there superintending the building of silos in 1911, which shows the value of a late cultivation:

"Late in August the condition of the crops on the station farm was such as to suggest that the silos then being built might stand empty. A field of kafir adjacent to the silo was scarcely knee high and apparently had not grown for several weeks. Nevertheless, Professor Ten Eyck, who was superintendent of the farm, had sufficient faith in the future to send out the two-row cultivators and go through this field when all conditions seemed to indicate that this labor would be thrown away. Rain came during the first week in September, accompanied by hail—which still further damaged the kafir—but the amount of moisture was sufficient to give it a fresh start. The late rain, combined with the cultivation which had served to check the loss of moisture previous to the rain, and delayed frost, resulted in the growing of quite a creditable crop of feed.

"I would urge the farmer facing a short feed situation to do all he possibly can himself, even though the situa-

tion looks discouraging. He has no control over the weather, but does have it within his power to give the stunted feed crop the last cultivation which may be the means of producing the necessary feed to enable him to hold the stock he might otherwise be compelled to sacrifice."

Saving Short Feed Crop in Silo. The reader will be interested in knowing how the above short feed crop was saved and what it accomplished, even though such statement may be considered out of place in this chapter. Mr. Wheeler's observation continues:

"If the station had been without the silos, it would have been impossible to winter the live stock on hand in a satisfactory manner, owing to the shortage of the feed crop. Every acre of kafir and corn on the farm was cut and hauled to these silos. In some instances the distance from the silo to the field was as much as two miles. During the extremely severe winter of 1911 and 1912 which followed, the cattle of the station farm had an abundance of roughage of the best kind and came through the winter in splendid condition. One hundred and forty head of animals were in the herd at that time. What would have been the result had the short kafir and corn been put up in shocks and stacks in the dry form, can readily be imagined by the live stock farmer familiar with such conditions.

"This is another argument for the silo for the live stock farmer under conditions which tend to produce short feed crops. With a heavy growth of feed we oftentimes can waste large quantities of it and still winter our stock in good shape. When feed is short, it is necessary to utilize to the best advantage possible, every ounce of feeding material which has been produced. A stock farmer near the station farm at Hays, in commenting on the results secured that season in the wintering of the Hays stock, stated that on his farm he produced a larger and better feed crop than was grown on the station farm. He had a smaller amount of live stock to winter, but

handled as he necessarily handled his feed, he had great difficulty in getting his stock through the winter."

Early Grain Harvest Gives Green Feed. Grain sorghums should be harvested in season, always, which is as soon as the grain has matured. Kafir, milo and cane hold their seed while standing in the field. Feterita shatters soon after ripening and the stalks fall. However, early harvesting will recover more grain than will late harvesting and in the case of kafir and cane the green stalks may be pastured most years before killing frosts. I believe that such pasturing is safe if the crops have matured grain. I have not heard of the loss of an animal from poisoning at this stage of the plant's development. A crop maturing grain in advance of frost would indicate that the plant had not been stunted and therefore did not contain prussic acid. However, I would recommend that caution be exercised until each farmer has thoroughly satisfied himself as to the safety of such practice. Horses and cattle eat the leaves first and later the succulent stalks to within six or eight inches of the ground. Such feed is needed in the early fall when pastures are short. This is the best way to realize the full feeding value of the kafir stalks when the crop has been grown for grain. The forage from thinly grown kafir is so coarse that when cured in the shock or standing in the field, it has a comparatively low feeding value, the waste is great, the forage unpalatable, and handling laborious. The pasturing of the kafir or cane field when the stalks are green gives feed which will greatly increase the value of the crop to the live stock-keeping farmer.

The stalk fields of milo are not so valuable for pasture as those of kafir or cane, because the leaves are not so abundant, the stalks are more woody and less succulent, and after the grain ripens the leaves dry, break off and blow away.

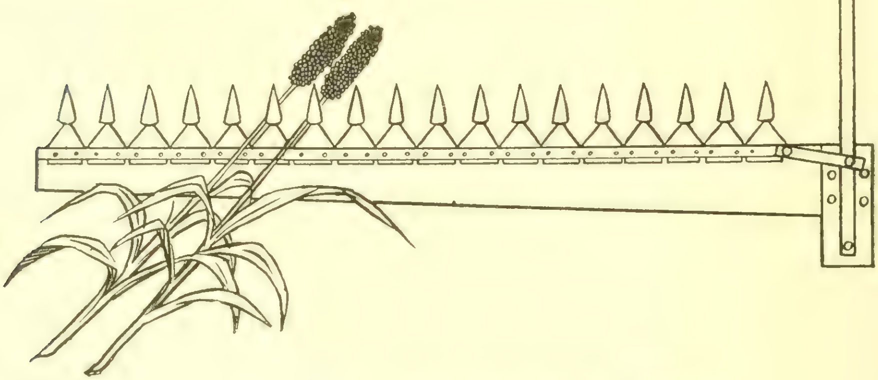
Wasteful Grain Harvesting. The prevailing methods of harvesting the grain of kafir, milo and cane, are ex-

tremely wasteful. It is commonly harvested with the corn binder, or, when the stalks are short, with the wheat binder; the bundles are shocked and at convenient times during the late fall and winter the bundles are topped with a hay knife, corn knife, hatchet, or axe. Such methods are laborious and the usual dry condition of the heads at this time results in shattering and unnecessary waste between the shock and the stack or storage. Another loss occurs as a result of the seed being exposed to the rains and snows while in the shock, causing moldy or germinated grain and consequent loss of feeding and market value. When topping from the shock is done at convenient times, or, more frequently as feed is needed, it is not unusual to find shocks standing in the field when spring planting time comes. Then a match is applied and both grain and roughage are burned. Often when the crop is not shocked it is allowed to stand unharvested in the field until mid-winter or later and by which time many stalks have fallen and the heads have been lost. Grain feed crops are too valuable to be handled in any such manner. If every grower could be made to realize that the heads of grain sorghums are as valuable as corn, much carelessness in handling would at once be overcome.

Best Harvesting Methods. The grain sorghums should be harvested when ripe as are other field crops. This, to establish a harvest time and that the harvest may be begun and finished with the same determination to rapidly bring the work to a close as in the case of corn husking. The topping can be done by hand at the rate of two or three acres per day, provided the crop has not been planted thicker than is advisable to produce a good yield of grain. In hand-topping, a hustling man and a lively stepping team hitched to a wagon with a large box, can make the harvest go at a rapid rate. I much prefer topping kafir or milo to husking corn. Having learned to top kafir in a section in which there was no corn to husk except in unusually favorable seasons, may be re-

sponsible for my preference. A heavy, sharp butcher knife, or a light, short corn knife, or a hand sickle one-half of which has been cut off, are best for hand work. Topping done in this way is three or four times as rapid as husking corn.

A Kansas Farmer subscriber, in Missouri, submitted this sketch for a handy and rapid kafir, milo or cane header. This is a mowing machine sickle bar and sickle, equipped with a long lever. The sickle bar is hung to the outside of the wagon-box with two



Missouri Sorghum Grower's Wagon-Box Header.

hooks made in the shape of the letter "S." The hooks should be made to snugly fit the bar and wagon-box side. The subscriber says the driver can easily work the lever as fast as three men can carry the loose stalks or bundles to the device. The heads fall into the wagon-box as cut.

The wagon-box header is well adapted to the heading of kafir, milo and cane. The Eagle Manufacturing Company makes such a machine. This header is attached to the side of the wagon-box and is driven by a chain from a sprocket attached to the rear wheel of the wagon. The machine can be adjusted up or down, by a lever, to suit the varying heights of stalks and the heading of one row at a time is done as fast as a team can walk.

The Acme Harvesting Machine Company builds a grain

sorghum harvesting attachment for its regular model of Hodges header. This attachment elevates the platform to a height of forty inches and will harvest dwarf kafir and milo without gathering an objectionable amount of stalks and leaves. The ordinary grain header may be adjusted to harvest these crops in seasons or in sections in which they do not grow too tall. It is desirable to block up the platform so that the sickle bar will cut high enough to reduce to a minimum the stalks and leaves gathered with the heads. Otherwise, harvesting sorghums with a header progresses as in the case of wheat.

While on a trip in Oklahoma during the fall of 1912, I observed the harvesting of a crop of dwarf kafir by the use of the ordinary wheat header and the farmer was doing a neat, clean job. The kafir did not average more than four feet high. This man had taken from Kansas Farmer the suggestion of pasturing the green stalks, and he was pushing the work as rapidly as possible. He turned the cattle and horses into the field almost as soon as the header started. The topped kafir stalks supplied abundant pasturage and the animals showed every evidence of appreciation of the feed.

I harvested kafir with the header one year but did not repeat the operation because so many leaves and stalks were gathered with the heads as to make feeding inconvenient and extravagant. Moreover, the green stalks and leaves caused the ricks of heads to mold. However, this latter objection would not hold if harvesting were delayed until after frost.

Storing Heads of Sorghums. Whether harvested by hand or by machine, the heads should be well stacked. Some grain which would ordinarily mold will be saved if the stack is started on at least a foot of straw, hay, or dry stalks. The stack should be made six to eight feet wide, ten to twelve feet high, and topped as is hay or wheat. Such stack can be easily built by one man, provided the heads have been topped short and not mixed with too many stalks and leaves. The heads should be

handled with a fork and a satisfactory stack can be built from the wagon. If the topping is done by machinery and more or less dry leaves and stalks are mixed with the heads, larger stacks may be built. In such case a man should be placed on the stack since the volume to handle is larger and some tramping is necessary for satisfactory stacking. Such general principles apply as in good stacking of wheat or hay. The middle should be kept full and the sides perpendicular until the top begins. The sides should be combed down with a fork and all loose heads pulled out. Such stack will turn rain.

In the eastern section of Kansas, Oklahoma and Texas, where the fall and winter rainfall is reasonably heavy, it will pay to top the stacks with long grass or rye straw, or, better still, with board or metal stack covers. Farmers in these sections are quite generally covering alfalfa hay stacks and there is equal need for protecting the stacks of grain sorghum heads. Farther west where the winter's precipitation is not so great, less care may be exercised in stacking, but it is not wise to risk losing a crop after it has been grown, and enough care should be given to save it.

Hand-topped heads, if thoroughly dry when harvested, may be stored like corn in the ordinary crib, the so-called portable corn crib or in a circle of woven wire. I have seen five or six rings of hog wire, one on top of the other, confining the hand-topped heads from a field of thirty acres and threshing a thousand bushels of grain. But unless the heads are dry when placed in a pile of such size, there will be danger of great damage by heating.

Threshing Grain Sorghums. Every good thresher of wheat or oats can successfully thresh the heads of sorghums. Most threshermen will refuse to run the forage through their separators and this method is not to be commended. It is expensive and laborious. If the threshed grain is to be fed, kernels broken in threshing will not be objectionable, but if the grain is to be mar-

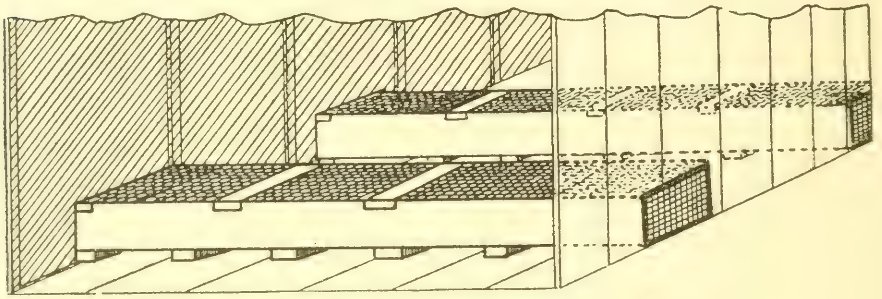
keted the threshing should be so done as to reduce the broken grains to a minimum. The grain should be well cleaned, also, because dirty grain is more inclined to heating in the bin and uncleaned grain of sorghums does not sell to as good advantage as cleaned. Elsewhere is given the market grades for kafir and milo. Threshing will throw some grain into the straw and this can be recovered by giving the calves, pigs and chickens access to the straw pile.

Thresh During Dry Weather. Threshing should be done when the stems and the grain are thoroughly dry, and should be delayed until as late as possible in the fall. A large and successful kafir grower of Ellsworth County, Kansas, says if kafir heads are left in the stack a year before threshing the grain will not heat in the bin. It is my observation, following experience, that kafir threshed during dry weather does not have the same tendency to heat in the bin as that threshed during damp weather. I believe that the grain of kafir, milo and feterita rapidly absorbs moisture and that this is largely contributory to heating. It is my opinion that the grain of the sorghums "sweats" in the stack and following which, if thoroughly dry before threshing, it will not heat in the bin, but if "sweating" does not occur in the stack it will take place in the bin and result in serious loss. This opinion is by no means conclusive, but I am sure that the grain of thoroughly dry heads threshed during dry weather will not have the same tendency to heat as in the case of opposite conditions.

The threshed grain of sorghums is regarded as difficult to hold without heating. Elevators storing such grain expect to move it from bin to bin so soon as heating is manifested. The exposure of the grain to the air dries and cools it. The farmer who stores the threshed grain can expect to do some stirring by shoveling in case heating begins. Usually heating occurs in the spring during the season of natural germination. However, the grower who sells his surplus soon after threshing need not worry

about heating, and that part of the crop which he feeds can be handled profitably and economically without threshing and which subject is discussed in a later chapter.

Bin Ventilator for Sorghums. Various plans for the construction of ventilated storage bins have been suggested and are regarded as more or less successful, but experiments directed toward handling in such way as



Sketch of George Bishop's Ventilator for Kafir Bin.

to prevent heating will lead to more economical and practical results. A bin ventilator which has given good satisfaction was designed by George Bishop, a large kafir grower of Washita County, Oklahoma, and which was described and illustrated in the Oklahoma Farm Journal, as follows:

"The ventilator is made of one-by-four pieces the length that the bin is wide, held together by one-by-two strips six inches long, covered on top and the ends with heavy fly screen. The plan of placing it is to cut a hole in the outside of the bin the size of the ventilator and even with the bottom of the bin. The ventilator is then inserted, resting on the floor of the bin, leaving the end, which you will note is covered with the screen wire the same as the top, flush with the outside of the bin, as indicated in the drawing.

"The cross braces, on the under side of the ventilator, are nailed onto the one-by-fours, instead of being set into them as are the braces on the top side. This is to permit

the circulation of air between the ventilators on a level with the floor. These ventilators should be placed at intervals of about every other upright or every third upright in the frame of the bin.

"If the grain becomes heated, the heated air naturally rises and the cool air is drawn in the ventilators and distributed through the body of the grain. If kafir bins are entirely inside of a barn, as grain bins usually are, they should be built of plain boxing plank. Neither shiplap nor tongue and groove stuff is necessary to hold grain of any kind for that matter, and ventilation will be aided by the small cracks through which grain will not waste so long as they are horizontal.

"Before filling the bin, it is better to hobble the ventilators together the distance apart they are to remain, because if the grain does not fill in on them evenly, they will be pushed to one side."

Harvesting Kafir and Cane Forage. The prevailing methods of harvesting drilled or thick listed kafir or cane for forage, are more wasteful than the common methods of grain harvesting. This wastage comes from two sources: first, because the crop is cut either so early or so late, that the forage does not possess its highest feeding value, and second, because the crop is cocked or shocked in such way as to result in excessive deterioration in quality and depreciation in feeding value. It is vastly important that all forage be so saved as to provide the largest amount of the best feed possible. Professional feeders have learned the value of palatability in feeds and also the value of feeds high in nutrients which can be assimilated by the animal. Feeding quality of roughage depends upon the stage of growth at which the crop is harvested and the manner in which it is stored, to a much greater extent than most farmers believe.

When to Cut for Forage. Kafir or cane makes the best forage if cut when the seed is in the dough. It is at this stage that it has the highest feeding value. Farmers generally recognize that the forage of immature

crops does not possess as great feeding value as crops nearer maturity, also that the immature forage is more difficult to save in good condition. It sometimes occurs that the crop must be cut earlier than desired that it may be rescued from extremely dry weather or from frosts. Such conditions were experienced in Kansas in 1911 and also in 1913. During those years much immature forage was harvested. That placed in silos gave the greatest feeding satisfaction it was possible for such material to give. During the dry fall of 1911 that held in the field kept fairly well; in the year 1913, however, that left in the field and exposed to the fall rains, molded and rotted badly and many a farmer who thought he had sufficient feed, was disappointed. If the immature forage of any plant has been well cured it is usually more palatable and more relished by the animal than that near maturity. This is especially noticeable in the case of prairie hay, millet, kafir and cane, but the observing feeder has noted that such forages do not produce the desired feeding results and the reason is, as feeders say, "the substance was not there." For silage, kafir and cane should be mature or just past the dough stage, but this point will be more fully discussed elsewhere.

Nutrients in the Several Stages of Growth. I have been unable to find figures showing the development of nutrients in any of the sorghums at the various stages of growth, but detailed data have been worked out on the changes in the corn plant covering the period from the time it comes into full tassel until the kernels are ripe. The changes in the composition of the corn plant may be safely applied to the forage of sorghums. The figures given below are taken from a table in Henry's "Feeds and Feeding," and are the results of the study of Ladd, of the Geneva, New York, Agricultural Experiment Station, on the development of nutrients in a measured acre of corn.

	Tasseled July 30 Lbs.	Silked Aug. 9 Lbs.	Milk Aug. 21 Lbs.	Glazed Sep. 7 Lbs.	Ripe Sep. 23 Lbs.
Weight, green	18,045	25,745	32,600	32,295	28,460
Water	16,426	22,666	27,957	25,093	20,540
Dry matter	1,619	3,078	4,643	7,202	7,918
Nutrients:					
Ash	139	201	232	302	364
Crude protein	240	437	479	644	678
Carbohydrates	1,168	2,272	3,703	5,996	6,562
Fat	72	168	229	260	314

From tasseling to the stage in which the kernels were in the milk, the gross weight of this acre of corn increased 14,000 pounds, and between this latter time and ripening the total weight decreased 4,000 pounds. It will be noted from the figures that as the corn plant approached maturity, the dry matter steadily increased, resulting in an increase in all the feeding nutrients. In the glazed stage this corn contained the largest amount of dry matter and it is at this stage that corn is regarded as making the best silage or fodder. It is altogether probable that the above data apply to Yankee corn grown in New York, which corn does not dent, and the glazed stage, no doubt, is equivalent to the dent stage known to every corn-growing farmer in the West. I feel it is not far amiss to consider the condition of our corn when in the dent as equivalent to that of the glazed period in the table.

The dent stage in corn corresponds with the late dough stage in kafir—that stage when the crushed kernel appears starchy—and it is at this stage that the forage or silage of kafir will yield the highest feeding value. Corn, kafir or cane cut in the milk, makes roughage which rapidly deteriorates when exposed to the elements, and silage which is "sloppy" and sour. Kafir or cane cut in the late dough stage will produce the best silage or forage. After the dent stage in corn or dough stage in kafir or cane, the constituents of feeding value decrease in the stalk and increase in the grain.

Harvesting Forage With Binder. The desire to harvest kafir and cane forage expeditiously and economically has led to the general use of the corn binder, and even of the grain binder in seasons or in sections in which the crop grows sufficiently short. Generally, when either implement is used, the crop is allowed to stand until mature to overcome the possibility of heating and molding in the center of the bundle. In fact, to overcome the possibility of such damage, I have known farmers to delay harvesting until the crop had been frosted. If harvest is delayed until such time the forage cannot make the best feed. In common practice when these crops are planted for both forage and grain, the importance of well matured grain holds precedence over forage value in the farmer's mind and this fact is responsible for the late cutting and the consequent poor forage, and is one of the good reasons why a planting should be made for each purpose.

Kafir or cane planted thickly in rows, for forage, as has heretofore been recommended, need not be permitted to stand in the field until near dry or exposed to frost, that the binder may be used. If the forage is thickly planted the stalks will be small and so will cure more rapidly than large stalks. In the thickly planted crop there will be more or less dead leaves on the lower part of the stalks. The small stalks and the dry leaves are contributing factors in curing. The binder should be adjusted to make small bundles which should be shocked almost immediately following the binder. The shocks should be set north and south or in the direction of the prevailing winds. They should be built only two bundles wide—in pairs of two bundles opposite each other, each pair taking the form of an inverted letter "V." The shocks should not be built longer than four or five pairs of bundles will make. The wind will blow through the V-shaped opening and the air will circulate around each bundle so that in favorable weather the bundles will cure perfectly. The

work can be so done that several such small shocks will stand together, and after curing the bundles can be set into one large shock for winter storage, or, better still, stacked near the feed lot. If the grain binder is used, it is likely that not more than two rows can be cut in one swath. If the stand is heavy, one row only can be cut.

West of the 100th meridian the usual season will be such as to permit this method of harvesting with perfect satisfaction, and it presents advantages and conveniences which every feeder will recognize. If the crop is to be put in the silo, cutting with a binder is far more economical and expeditious than other methods.

The Corn Sled. In case the farmer does not have either corn or grain binder, then the corn sled—either home-made or manufactured—stands next from the standpoint of convenience. The shocks should not be made too large to permit of ready curing. Small shocks so made will cure more rapidly than shocks of bound forage. The cutting of thickly planted sorghums with the corn knife is not necessary unless the acreage be small. A home-made corn sled will require a cash outlay so small that the farmer in the most straitened financial circumstances can afford to build one. The use of the corn sled is illustrated on page 66.

Harvesting With Mower. Each year a large acreage of sorghum forage crops is cut with the mower and placed in cocks in the field. While in general practice this is most wasteful, there is no reason why it should be, and such method is reasonably expeditious and will permit saving the forage in fine condition. The mowing should be done when the weather is favorable for curing. Should the crop be ready to harvest in the midst of a spell of threatening or wet weather, it is better to leave it standing than to cut it and be unable to effect satisfactory curing. This remark applies to all methods of harvesting all sorts of forage crops.

If the ground is wet during or following cutting, curing will be difficult. Under these conditions curing can

be promoted by cutting the stubble longer than is common, and this will to a great extent prevent the cut forage from lying on the ground, giving the air a chance to circulate below and through it. If the ground is dry and the sun shining when the crop is mowed, it will cure rapidly even though the stand is thick. The term "curing" as here used, is intended to convey the thought of drying the forage to the point that it will keep in the cock without heating and molding, and not in the sense that the juices of the plant are to be evaporated until the forage is totally robbed of the constituent ordinarily called water but which cannot be returned to the plant by any means of watering. The forage should be cured to the point that in raking and handling the leaves will not break off the stalks or pulverize and blow away. The proper curing of the leaves is usually an indication that the stalks of thickly grown kafir or cane are also properly cured. When the stalks are small—ranging from the size of one's little finger down—this stage of curing is easily reached. If the stalks are large the leaves are likely to become too dry before the stalks are cured sufficiently to put in the cock.

Weather conditions should govern the rapidity with which the crop can be mowed, cured, and cocked. In general, the same careful methods of saving the kafir and cane sowed crop should prevail as in the case of alfalfa. The farmer whose force is composed of only two men, would not regard it good judgment to have forty acres of alfalfa on the ground at one time. He would mow six or eight acres and get this into the stack, and repeat this operation until the entire crop was harvested. The same precaution should be exercised in putting up sorghum hay. In showering or threatening weather the crop is much better standing than on the ground. Kafir and cane hay is injured fully as much when exposed to rains or other unfavorable curing conditions, as is alfalfa. In order that the entire forage crop be not ready for harvest at the same time, plantings may

be made three or four days apart, and this is a practice followed by a good many farmers of my acquaintance.

Generally speaking, the above precautions are not taken in the saving of kafir and cane forage. This, because of the generally accepted idea that kafir and cane are not damaged by exposure and so do not require careful handling; and second, because they are not regarded as high quality roughage and therefore the loss in quality of feed is not considered as important. We have too long gone on the theory that the principal purpose of feed is to fill an empty stomach and not that the feed given have in it the nutrition necessary to properly maintain the animal.

Handling Mowed Forage in Field. Neither kafir nor cane forage readily stack-burns. Usually it is so coarse that it does not settle rapidly and so thoroughly cures in the small cocks in which it is put. However, it is the part of wisdom to take a chance on a little stack-burned forage in the center of a large cock, rather than place it in small cocks and take the chance of the rains and snows spoiling the entire crop.

I recommend the building of cocks containing at least one good-sized hay rack load or 1,500 to 1,800 pounds. The best way to get the forage to the cock is to use a strong, two-horse hay rake, driving the rake just far enough into the swath to load, and drawing to the cock by the shortest route. A dozen or more rake loads can be pulled together, each on top of the other, to form the foundation and subsequent rake loads drawn to the side of the cock. Two men can be used to good advantage, each pitching onto the cock, one tramping it occasionally until the cock reaches the height when topping should begin. Then one man should mount the cock and top it out. The pitchers should keep in mind that the middle of each cock should be kept full. Continuous combing down with the fork will remove all loose stalks, giving the cock good form and leaving the sides in such condition that they will readily turn water. The top should

be well constructed, and sharp, for it must protect the entire quantity of feed from damage by rains. So soon as the cock is finished, or at least before the winds have blown the top off, it should be tied down.

The advantages of the large cock are that the feed will keep perfectly and so well that it can be carried over into the following season with assurance of good feed coming from it. There is a quite common belief that it does not pay to hold kafir or cane forage from one year to another. Handled in the ordinary way, it does not pay, but if cocked in the method above described the advantages are apparent in the quality and in the total quantity saved. Furthermore, the heaviest snow will not bury the cocks, and the easy access to and the saving of labor in loading and hauling in bad weather will fully offset the additional labor and care required. If the reader has never tried saving kafir or cane in large cocks, he cannot appreciate these advantages. To make large cocks is not laborious, either. The delivery of the forage to the cock on all sides by the horse rake, overcomes unnecessary labor in pitching and the use of the horse rake does not tangle and compress the forage to the point that pitching is as difficult, as when the go-devil is used.

I would prefer five acres of cane or kafir forage put up in this way, to ten acres put up in the ordinary small cock of four or five forkfuls. I have fed thousands of tons of cane and kafir forage so put up and have been able to observe the highly satisfactory results from feeding forage which was green and succulent and possessing the aroma of newly mown hay. The reader, after one trial, will realize the superior results obtained from such forage as compared with that indifferently harvested, cured and stored in small cocks and which has been wet through and through before feeding. The forage of kafir and cane is good forage, as it grows in the field. If it is not good when placed in the feeding racks its inferiority is due to poor handling.

Sorghums as Green Manure. For that part of the sorghum belt west of the 98th meridian the plowing under of sorghum crops affords the cheapest, quickest and most easy means of getting the needed vegetable matter into the soil. These soils, handled by the long prevailing methods, are deficient in vegetable matter. The plowing under of sorghum crops does not add nitrogen to the soil as do cowpeas or clover, but the decaying of such crops makes plant food already in the soil more available for the growing crop. The soils of the sorghum belt are generally fertile, but have in the past been so farmed that the food for plants is not readily obtainable by them. In the Kaw Valley it is not uncommon for farmers to plow under enormous crops of turnips and rape, sown in the fall after other crops are removed. The sorghums will do for the Western farmer what these do for the Eastern Kaw Valley farmer. If on every quarter section farm lying west of the 98th meridian, ten acres of green sorghum were plowed under each year, farm owners would realize that they were cultivating a different soil—so marked would be the handling and cropping results as compared with the present.

"A field I sowed to cane in June and plowed under after a frost, covering it wholly, made the soil, for several years, more mellow and moist than any other on the farm," writes A. H. Griesa, of Douglas County, Kansas.

Kafir Good Substitute for Corn. "My experience leads me to believe that kafir is more sure to make a crop than corn and is a good substitute. I do not think kafir can be successfully followed by wheat drilled in the stalks. I do not regard the fodder of great value when the kafir seed has matured," writes H. M. Laing, Russell County, Kansas.

Most Planting Too Thick for Grain. "Most farmers plant kafir too thick for a grain crop. This is especially true of dry seasons," writes an Oklahoma County, Oklahoma, subscriber to Kansas Farmer. "I stop up every second hole in the kafir drill plate with lead. This drops

right for good-sized heads in this country. I have wondered why more farmers did not plant kafir. It is the surest crop we can grow. When kafir is planted and cultivated as it should be the crop will not fail. I have grown kafir here in Oklahoma for thirteen years without a single failure. In 1911 I grew thirty-five to forty bushels per acre on the highest ground in this country."

Kafir, Milo and Feterita Similarity. It is apparent from what has been said in the preceding pages that kafir, milo, feterita and cane farming are so similar as to make unnecessary extended individual treatment. The farmer should study the adaptability of each to the needs of his farming plan, keeping in mind the limitations of the precipitation and the length of the growing season for his section, and use the crop best suited to his conditions. The planting, cultivation, harvesting, and feeding, so closely resemble corn growing and feeding methods, that the farmer who knows how to grow and feed corn need have no doubt of his ability to succeed with the sorghums.

More Kafir, Cane and Milo. This chapter, having to do with the farming of the sorghums, could not close with more fitting remarks than the following by J. H. Miller, dean of the agricultural extension department of Kansas Agricultural College, and while directed to the farmers of Kansas, apply with equal force to farmers in every section of the sorghum belt:

"Kansas farmers should depend more on kafir, cane and milo. These will insure—as nearly as that is possible—the feed needed for all the live stock the farm will carry.

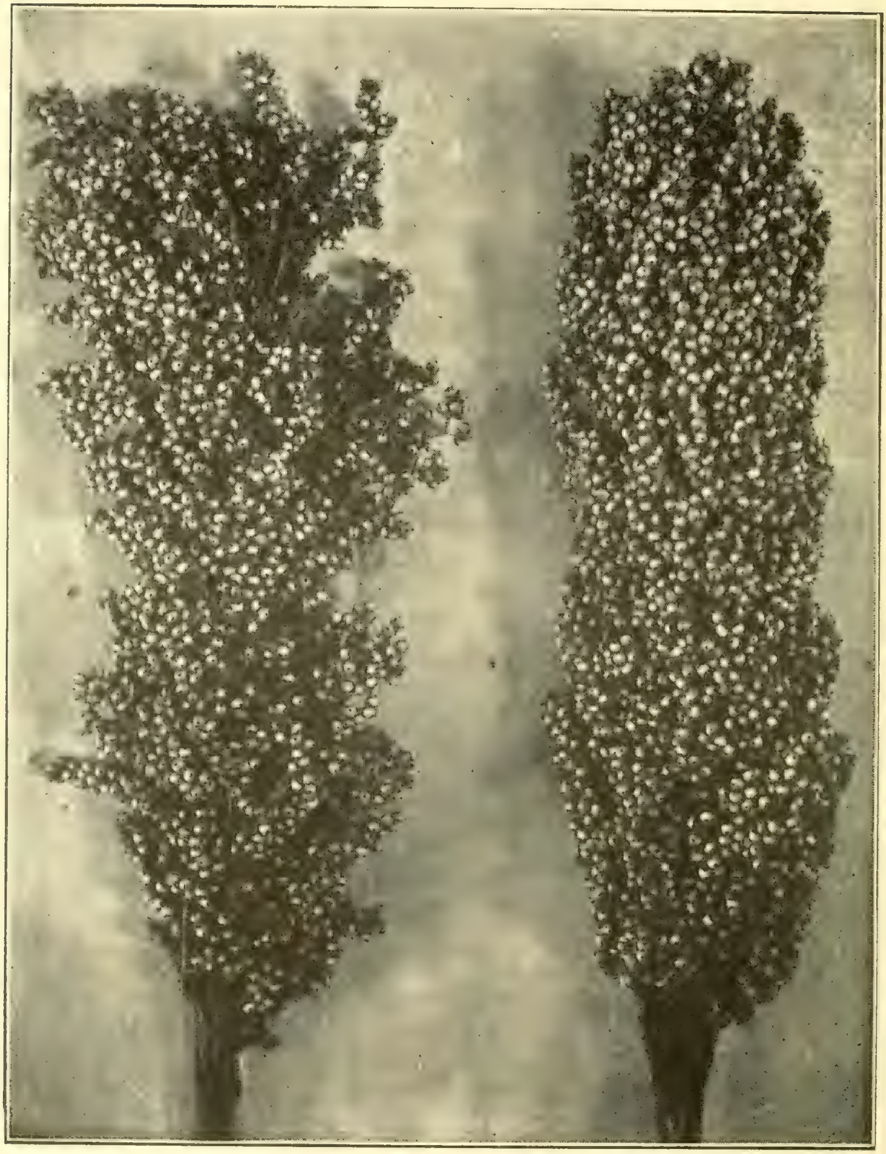
"There are but few counties in Kansas where I would not advise farmers to plant more acres of these non-saccharine sorghums. Seven-tenths of the farmers of Kansas push one crop to the extreme. Those of Western Kansas grow too many acres of wheat, and those of Eastern Kansas grow too many acres of corn. Good farm management would reduce these 'one crop' acreages and

divide the rush labor periods. The wheat counties must change and grow more corn or more sorghum in order to grow more live stock. Furthermore, such a plan would reduce the summer plowing and allow every farmer to complete his plowing for wheat by August 15 and thus get a better seed bed and a bigger crop.

"The Eastern Kansas farmer who tries each year to increase his corn acreage is equally at fault. Kafir will outyield corn in most years, and I think the average will be about equal for a ten-year period. The reduced corn acreage will enable the farmer to get his corn planted in better shape and in better time, and he then could plant his kafir, and thus through the season his kafir work would come in just a few days later than his corn work. Whenever kafir is followed by corn or oats, the ground should be plowed in the fall to allow it to get more moisture. Kafir is not any harder on ground than corn, as far as fertility is concerned, but it does take more moisture, and therefore the fall plowing or fall disking. The fall work is also nicely divided.

"I have been recommending the following proportion of feed crop acreages for Kansas: Eastern sixty miles, one-fourth to kafir, three-fourths to corn; next one hundred miles, one-half to each; next one hundred forty miles, three-fourths kafir and cane, and one-fourth corn; last one hundred miles, nine-tenths to kafir, cane and milo, and one-tenth (if any) to early varieties of corn. With the right kind of farming there is seldom any necessity for a loss of feed of kafir, cane or milo. Milo should be grown on every farm in the extreme western counties.

"Many farmers make two serious mistakes in the handling of kafir: (1) They neglect to work the ground early enough in the spring, seeming to act under the impression that, because kafir is a dry weather-resistant crop, it does not need any moisture saved for it. (2) They almost universally neglect to gather seed from the field, when they could select the early ripening heads and thus, by breeding, shorten the growing period needed and also have their fields ripen uniformly the next year.



The Head to the Right Is High Yielding Head of True Kafir Type and Typical of a Field Yielding 80 Bushels per Acre in 1912.—The Head to the Left Is a Low Yielding Head and Typical of a Field Yielding 20 Bushels per Acre in 1912.—The Reader Should Note Carefully the Difference in the Type of the Two Heads and Should Plant Seed from High Yielding True Kafir Type Heads Only.

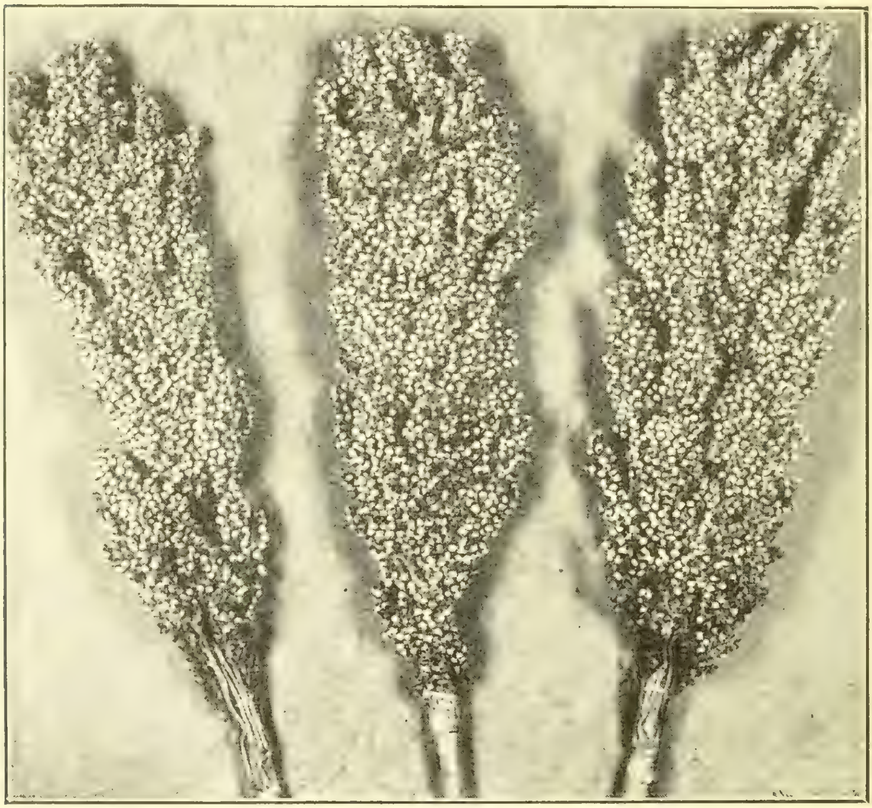
BETTER GRAIN SORGHUM CROPS.

During the fall of 1912 I received many inquiries from readers of Kansas Farmer who sought to know the cause of the general annually decreasing yields of kafir. The call for help came from every section of Kansas and indicated a deep-seated desire to know the truth. The investigation made in an effort to correctly answer these inquiries, and the observations incident thereto regarding grain sorghum farming in general, resulted in my decision to write this book. In every locality in which I sought information, there prevailed a lack of appreciation of the possibilities of kafir and other grain sorghums. I soon arrived at the conclusion that the grain sorghums were not as well understood as their value warranted and this book was conceived as a result of the desire to contribute something which might encourage the reader in better grain sorghum farming and a consequent larger return for his labor.

For years I was a grower of kafir as the crop of principal dependence for grain and forage, and in my travels and visits among farmers in every county in Kansas during the last ten years I have made observations which appear to me as being of value. So, it may be said that this is not a burst of spontaneity but is the record of a lifetime of reasonably intimate relationship with the sorghums and sorghum growers. For years I had noted the decreasing yields of which my inquirers complained but had no occasion to place my conclusions in type until I became actively engaged in editing a farm paper, which duty I have taken so seriously as to make an honest endeavor to learn and write of those things of some money value to the man who tills the soil.

I had long held that the decreasing yields of kafir were

due to neglect in seed selection, because I could see that the prevailing type of kafir head of recent years was widely varying from the type introduced into Kansas in the early "eighties" by the Federal Department of Agriculture through the Kansas Agricultural Experiment Station. In my experience I had learned the necessity for keeping the seed of kafir pure and the difficulties en-



These are Better Heads Than the Average of Kansas Kafir Fields, Yet Low-Yielding.—See Illustration 234.

countered in preventing cross-fertilization or "mixing" with cane when growing the two crops on the same farm, or even on adjoining farms. I had observed that on few farms was any effort made to maintain either the purity of kafir or the yield, by selection of choice heads for seed.

My correspondence with inquirers developed the fact that they, too, realized these conditions but failed to understand why the seed had "run out" and did not know how to re-establish kafir to its former usefulness. However, in my search for higher than common yields and the contributing causes therefor, I found an occasional grower who had maintained good yields and in whose hands the performance of the crop had been so satisfactory year after year as to warrant an increasing appreciation of its dependability.

Yields to be Expected in Kansas. Investigation developed the fact that there are many farmers who do not have a true conception of the grain yields to be expected from kafir. To be sure, the yield of kafir will vary under those conditions which produce varying yields of other crops. I was unable to obtain from inquirers or others, any accurate data as to former grain yields that a comparison might be made with acre yields in more recent years, but in nearly every case the answer was that kafir now yields less than half as much as formerly.

On page 88 it is shown that the average kafir grain yield per acre for the eleven-year period, 1889-1899 inclusive, was 46 bushels as compared with 34.5 bushels of corn, at the Manhattan, Kansas, Agricultural Experiment Station. On page 89 it is shown that at the same station for the thirteen-year period, 1901-1913, the average acre yield of kafir was 50 bushels as compared with 58 bushels of corn. It is believed, however, that the corn grown during the latter period was better adapted and of heavier yielding varieties than was the corn in the first named period. A close examination of the figures on these pages would make it appear that the yield of kafir in a year favorable to corn should be at least equal to the corn yield, and in seasons unfavorable to corn the grain yield of kafir should greatly exceed the yield of corn. Reliable figures herein contained show that for the so-called "poor" corn year—except in sea-

sons of near total failure for both crops—the kafir yield is double the yield of corn and in some years even more than this.

Numerous other references to yields occur in the preceding pages but incidental to elaboration upon other points. However, individual yields in various sections of Kansas throw some light on the yielding ability of kafir and on what farmers can expect from selected seed of near pure strains.

O. W. Prather, Jewell County, Kansas, wrote in April, 1912: "My kafir in 1910 made 60 bushels per acre on thin upland and my 1911 crop was as good. The average weight of a cured head from my field was one-half pound. I select seed from the field, hang the heads in the shed to dry, and store until ready for planting."

"Kafir can be made to reach the 40-bushel mark on any upland in Kansas by proper cultivation and selection of seed. I have grown it as a main crop from its first introduction, and in feeding value find it in every way the equal of corn and the fodder is much superior to that of corn. The farmers of the state have been so careless in selecting seed that much kafir does not mature before frost. I have kept mine from maturing later than September 10 and any one can do this by selecting the earliest maturing heads each year," writes J. G. Mitchell, Wilson County, Kansas.

J. W. Berry, Jewell County, Kansas, in March, 1913, after reading Kansas Farmer articles discussing kafir seed selection and illustrating high and low-yielding types of heads, wrote me: "Your article will prove a revelation to kafir growers. I have been following its principles of seed selection for many years. Our kafir in 1912 made nineteen tons of silage per acre. While filling the silo, twenty boys of the agricultural class of our high school made an estimate of the grain yield, by harvesting the heads from several average rows, drying and shelling them and weighing the threshed corn, and they reported 125.2 bushels as the acre yield. I am sure

the yield for the entire field was between 80 and 100 bushels. Three years ago my kafir grown from the same seed made 83 bushels per acre."

Other 1912 kafir yields reported were: Frank Lalodge, Sedgwick County, average, 63 bushels; forty-one acres grown by Press Kid, Chase County, yielded 60 bushels per acre; and Frank Stewart's field, also of Chase County, yielded 90 bushels per acre.

A general farmer of Butler County, Kansas, who grows all he can and saves all he grows, is J. J. Johnson. His average has been 50 bushels of kafir on upland which produces only 20 bushels of corn per acre. Mr. Johnson selects seed heads in the field and plants from the true type only.

It is interesting to contrast the above yields with the average of those 32,160 Kansas farms which reported kafir yields to the Federal Department of Agriculture in the 1910 census, which average was 13.2 bushels per acre. It may be considered that the census report is near a correct average for the state in that year and which was the year of the third highest average acre value during the 1901-1913 period. It is to be remembered, of course, that these averages include the acreage sown for combined forage and roughage—conditions which are not favorable to high grain yields.

Low and High Yields for Oklahoma. Earlier in the book will be found authentic farm yields for Oklahoma, ranging from 60 to 124 bushels of grain per acre. These are reported in connection with pictures of high yielding type of heads and these yields are in striking contrast with the average acre yields for that state reported on page 79.

In one of the best farming districts of Grady County, Oklahoma, and in which county kafir has been grown for years, yields of only 15 to 25 bushels are reported and good farmers of Kingfisher and Garfield counties report about the same yield for their counties. A Canadian County, Oklahoma, banker says the yields of kafir

in his county do not exceed eleven bushels per acre and until he was shown the effect of type on yield and the results from growing high-yielding strains, he was advising the farmers of his county against planting kafir.

It is interesting to compare the yields in those counties where kafir has long been grown—and in which counties no attention has been given to seed selection—with those of counties recently engaged in growing kafir and the farmers of which obtained choice seed. In Greer, Carter and Johnson counties there are districts where kafir was grown in 1912 for the first time, the seed having been purchased from growers of high-yielding strains. In these districts there were many yields of 65 to 85 bushels per acre. Neither soil nor climatic conditions were more favorable than in the districts where 11 to 25 bushels per acre were grown.

In the face of these facts it would seem that the farmers of Kansas and Oklahoma were justified in inquiring into the cause of low yields. It would also appear that the farmers of Central Kansas and Oklahoma who did not in 1912 grow at least 40 bushels of well matured kafir per acre, should get better seed, and the yields above reported should hold much hope for those who seek such standard.

Causes of Disappointing Yields. It has already been explained how late, thick and careless planting, poor cultivation and late maturity, contribute to low yields. That each of these conditions has its effect on yield, is beyond question. Another important and principal cause, however, is the planting of seed from a low-yielding type of head and which has the same result on kafir yield as would the planting of corn from nubbins.

The low-yielding type of head has small capacity for bearing seed because of the loss of those characteristics which prevail in heads of large seed-bearing capacity. It is a hybrid—the result of mixing by cross-fertilization with other sorghums, principally with cane or broomcorn, or both, and which are commonly grown in the kafir-producing sections. The low-yielding head is in fact the re-

sult of permitting the seed of pure kafir to "run out" through failure on the part of the grower to select heads of the true kafir type and so keep the seed pure. The planting of such seed year after year has resulted in degeneration to the point that the low-yielding head is the generally prevailing field type.

There is a marked difference in seed in its ability to produce vigorous plants and such as are likely to give a good yield. The vitality of seed is dependent upon the character of plant upon which it was produced, its maturity, and the conditions under which it has been kept from the time of maturity in the field until planting time. Seed of high vitality is produced only on vigorous stalks, the seed from less hardy stalks being of low vitality and not able to overcome the vicissitudes which frequently befall the crop during the growing season. Vigorously growing seed is that which has been fully matured; it has a fully developed embryo which is provided with a maximum of plant food for the support of the young plant until the roots can take food from the soil. In the immature seed the embryo is not well developed, the food supply is reduced and the seed has the same small chance to overcome adversity and develop into a high degree of usefulness as has the runt of the litter to become a 300-pound porker.

That the neglect to select mature seed heads and give them proper care until planting time has resulted in seriously affecting the yield, can be better understood by observing the manner in which the seed on most kafir-growing farms is handled. For ninety-nine of every one hundred fields the seed planted is taken from the bin. The early and late maturing heads, the mature and immature, the heads of hybrid kafir and those of cane or broomcorn, are threshed together and the seed thoroughly mixed. There is no means by which these seeds can be completely separated before planting. The time of harvesting and threshing and the method of storing are not such as to prevent damage by the elements or overcome

the effects of heating in the bin. This mixture of seed is planted as a year-after-year practice. The degenerating effects of such handling have been cumulative to the point that the resulting crop can in fact no longer be known as kafir. Nor is this an exaggeration of the common method of handling kafir seed.

Here are some of the direct results of planting such seed and each of which has its effect on the yield:

Seed from hybrid heads produces a hybrid and which, in kafir, is a low yielder.

The planting of mature and immature seed causes uneven ripening and the slow growing plants do not mature before frost.

The varying vitality of mature and immature seed frequently results in a poor stand, the less vigorous plants perishing under unfavorable growing conditions.

The vigor of all seeds is affected by bin heating, often resulting in a complete failure to secure a stand and necessitating late and unseasonable re-planting.

Failure to get satisfactory stands from early planting, as a result of all those conditions which affect vitality of the seed, has caused growers to plant at least ten days to two weeks later than would be required in the case of vigorous seed. Late planted and slow growing seed cannot take advantage of the usually favorable conditions of the early growing season.

The failure to select the earliest maturing heads results in the use of a greater number of growing days and later maturity of the crop.

Other conditions which affect the usefulness of the crop are those which depreciate the market and feeding value of the grain as a result of the loss of the pure strains, the generally smaller tonnage and poorer quality of forage, and the inability to facilitate harvesting when the stalks grow at varying heights and the heads ripen at widely varying dates.

So it may be said that the disappointing kafir yields are the result of careless handling of the seed and which

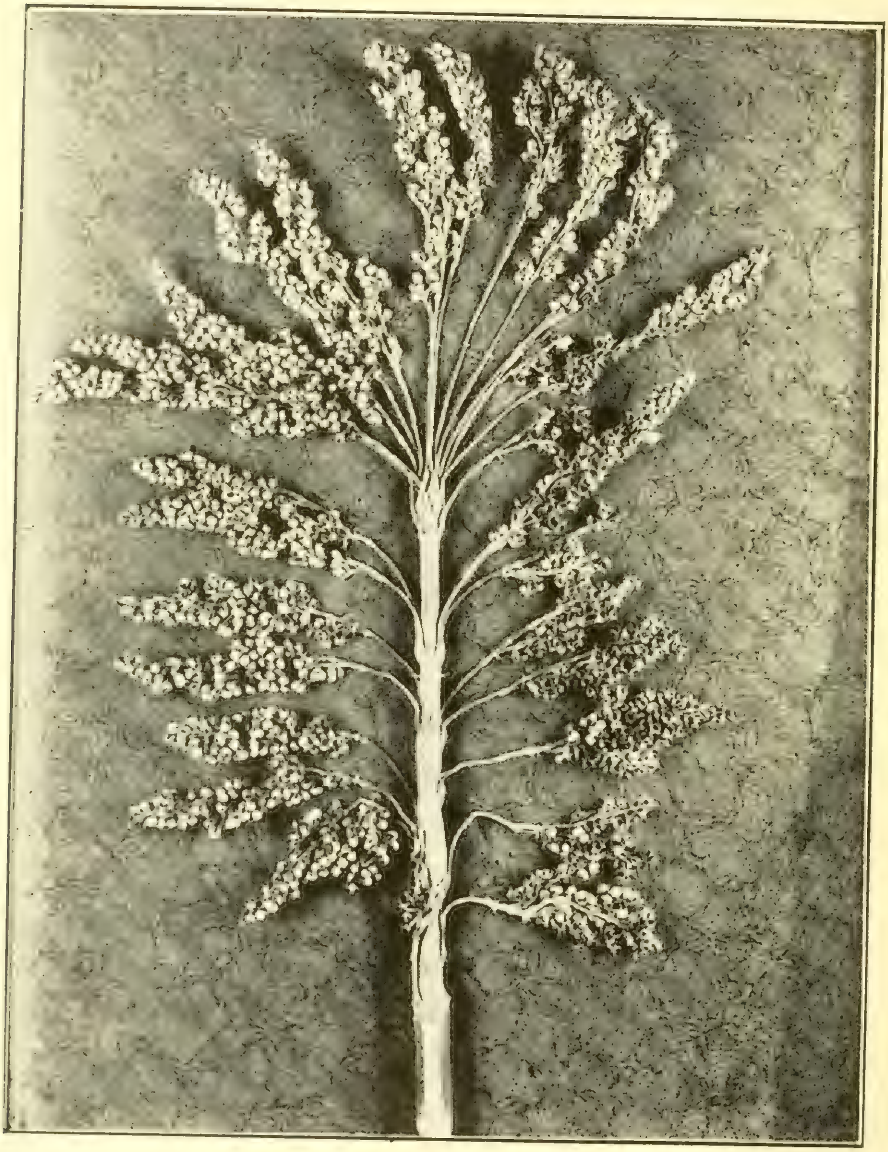
is responsible for the yields throughout Kansas and Oklahoma having been reduced to one-third or one-half of what they should be, and even rendering kafir an impossible crop in the drier sections and those of comparatively short growing seasons.

If the kafir crop is to be restored to its former usefulness or to its highest degree of usefulness, the grower must be careful in the selection of mature seed heads of high-yielding type, must employ such methods as will keep the seed pure, and must store the seed in such manner as will maintain its vitality. These precautions, with better planting and cultural methods, will re-establish kafir to its former and proper place on sorghum belt farms. Every-year vigilance only will controvert degeneration in kafir or other crops.

No Good Reason for Late Maturity. "There is no good reason why kafirs cannot be made to mature earlier than they do now, by paying careful attention to seed selection," writes Director Jardine of the Manhattan, Kansas, Agricultural Experiment Station.

"The conclusion of this department is that if a reasonable amount of care is given to the selection of the seed for the kafir crop, practically no trouble need be feared as regards the time of maturing, or the grain yield of the crop," says A. H. Leidigh, assistant professor in crops at the same station. He continues: "In the extreme western and northwestern parts of Kansas, constant care and attention will be required to keep the plant early enough to be sure of its maturing seed. This latter condition is comparable to the corn situation in the northern part of the corn belt, and I believe you realize that in the northern part of the corn belt they meet such a condition by the careful selection of early home-grown seed instead of by the renewal of seed. We have grown kafir at this station since the latter part of the 'eighties' and have not experienced anything which indicates that our seed is running out."

Typical Low-Yielding Heads. The picture below is that of a low-yielding head of kafir, although it is a head much above the average of many fields. A



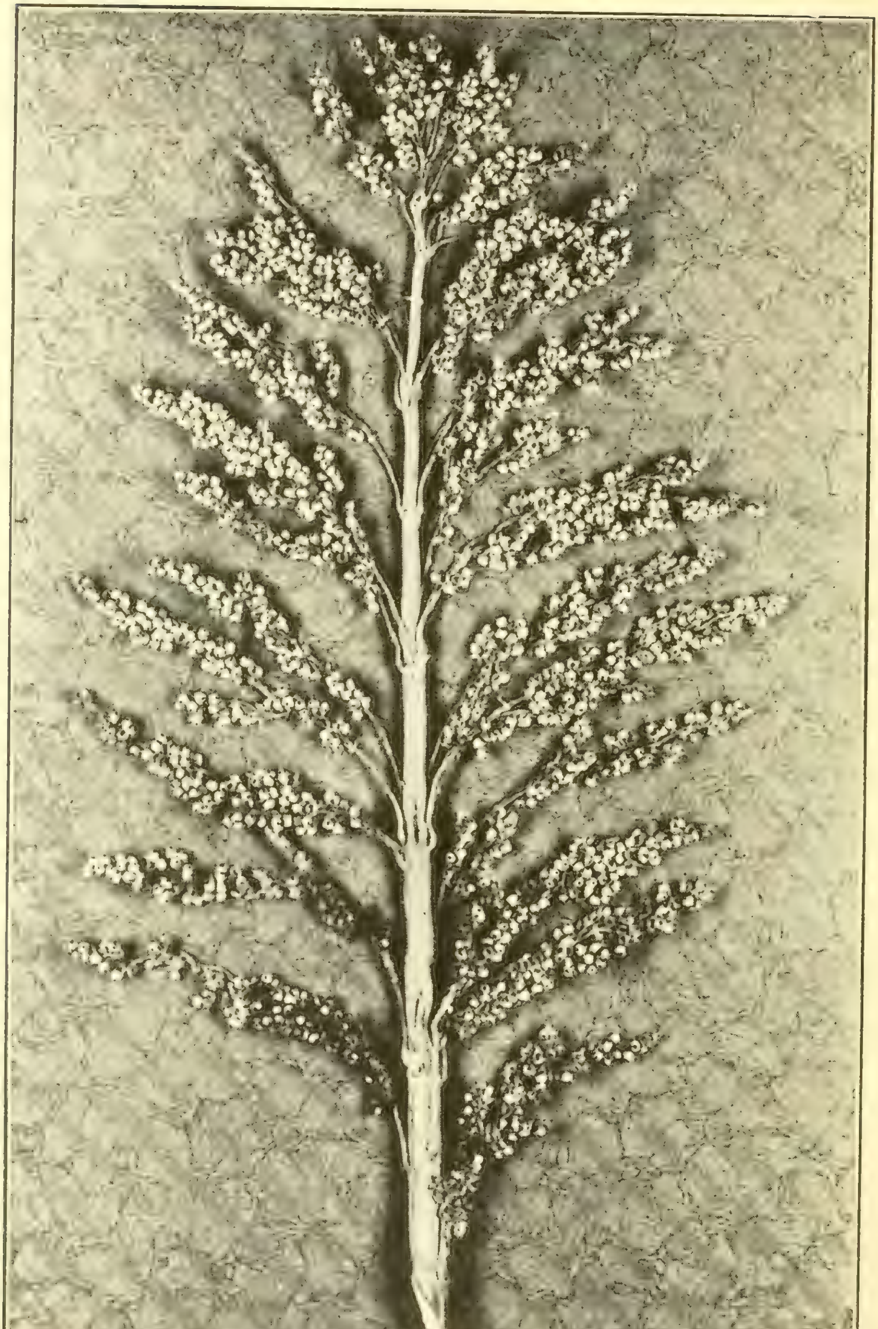
Interior of Low-Yielding Kafir Head.—Note Short Main Stem and Light-Yielding Seed-Bearing Stems.—Such Heads Have Small Capacity for Bearing Seed.—Compare with Illustration, page 236.

head of poorer conformation than this should not be saved for seed. This head is a mate to the three shown on page 226. These three heads should be compared with the four in the picture on page 184. These are all typical low-yielding heads and comparison with the dissected head will reveal why the seed from such should not be planted, provided it is possible to secure seed from heads of better form.

The dissected head measured twelve inches from the tip to the first joint at the bottom, and weighed four ounces. The main or center stem was seven inches long, having six joints from which seed-bearing stems grew. The seed stems were five inches long at the tip. The greatest width was at the tip, where the head measured five inches. Note that the seed-bearing stems were of irregular length, unevenly seeded, and that the longest and heaviest seeded stems were those at the tip. Observe also that at the tip there was a cluster of seed stems which spread and gave the fan shape typical of mixed and low-yielding heads. The loose and open appearance of the head was due to the fact that near the center stem there were no seeds, thus accounting in part for the light weight of the head. Seed-bearing stems having seed only one-half their length, are comparable to the corn cob which is only half filled.

A close examination of the illustration will result in obtaining a good idea of the low-yielding type of head, and the above points are mentioned only to call attention to the difference between this head and the high-yielding type elsewhere shown. It should be kept in mind that the dissected head is not an extreme example of low-yielding type. Every reader has seen fields in which the prevailing type of head was much less desirable than that shown, but this type is presented because it comes near being that of the average field.

The three heads shown on page 226 were typical of a field which on upland in Shawnee County in 1913 yielded 25 bushels of grain per acre, and were awarded first prize



Interior of High-Yielding Kafir Head.—Shows Large Seed-Bearing Capacity.

at the Indian Creek, Shawnee County, Grange Fair, October 2 and 3, 1913. This field of kafir matured a month in advance of killing frost. The grower has for years been selecting for early maturity and his success is amply demonstrated by the performance of the seed in a year like 1913, when most fields in that neighborhood were frosted in the bloom. This is a striking example of maintaining earliness by selecting early-maturing heads.

Typical High-Yielding Heads. The picture on page 236 shows the conformation of a high-yielding head of kafir. This head measured sixteen and one-half inches from tip to the first joint at the bottom. It weighed eight ounces when thoroughly dry and after losing considerable of its seed as a result of many handlings. The main stem had nine joints from which fifty-two seed-bearing stems grew, and each stem was seeded almost its full length. In this head all of the available space for seed was occupied, resulting in a heavy, compact head. In every respect this head showed large capacity for carrying and producing seed and it would seem that a head of such conformation should prove a superior yielder.

This head was one of the nine shown on page 248. These heads were grown in 1913 and showed the effects of dry weather in that the seed was small and many glumes were not filled. Undoubtedly, in a season of normal rainfall they would have been better filled and consequently heavier. Each of the heads in this illustration has the same conformation as that of the dissected head and which conformation is common to all of the high-yielding heads illustrated in this book.

I found this the prevailing type of head in every high-yielding field, and it is unquestionably the best type to select for better cropping results. At any rate it is the type of kafir head first grown in Kansas and which upon introduction gave better yields and greater crop assurance than has the seed planted in recent years from heads varying from this type. It is the type of head preserved by the occasional grower who reports the greatest satis-

faction from the kafir crop. It is the type indicating the inherent hardiness necessary to withstand dry weather and if kept early-maturing will evade dry weather.

High-Yielding Type Described. In March 1, 1913, issue of Kansas Farmer, was printed this description of the high-yielding head, written by H. M. Cottrell, who has given head type a thorough study:

"The head should be three to four times as long as broad, cylindrical, only slightly pointed, but compact to the very point. The loose, sprangly head, and which gives low yields, is rarely ever longer than twice its extreme width, the top is open and fan-shaped and generally is wider than any other part of the head.

"The main stem in the kafir head, corresponding to the cob in the corn ear, should be strong, straight and short-jointed and extend to within two or two and a half inches of the head tip. High-yielding heads will have six to ten joints and the seed-bearing stems will grow closely around the main stem from each joint. The more joints, the greater will be the number of seed-bearing stems and the greater the bearing ability of the head. In low-yielding heads the main stem does not exceed one-half the total length of the head and branches into long seed stems which spread and give the head its loose, open top and fan shape. The short stem can have comparatively few joints, usually not more than three or four, and the seed-bearing stems are correspondingly decreased.

"The seed-bearing stems should grow close together, completely surrounding the main stem at each joint, and will, as a rule, be shorter than in the low-yielding or mongrel head. The seed stems should be thickly set with seed from the tip close to the main stem. In the low-yielding head the seed stems are farther apart, fewer in number, long, and not seeded more than half their length, making the bushy, light head so common in kafir fields. Not infrequently fairly well-shaped kafir heads will pos-

sess some of these undesirable characteristics and for this reason the interior of the head should be examined.

"The base of the head should be well set with seed stems, beginning at the first joint on the main stem. The seed stems should grow outward and upward from the main stem, should be well filled with seed and so make the butt of the head almost square and as broad as the head at its middle. In the case of the low-yielding head the butt is the narrow part of the head, the light seeding allowing the seed stems to grow upright. In the mongrel head the seed-bearing stems gradually grow longer as they approach the tip of the head and the longest seed stems are those of the tip.

"The base of the head should be free from mildew, mold or discoloration, the seed should be mature and the quality otherwise as good as that found elsewhere on the head.

"On the well-matured head grown in a season of normal rainfall the seed should be large and every glume or hull occupied by a seed.

"The well-bred type of head above described withstands the dry weather and other adversities and produces the heaviest yield—because it is kafir of a pure strain. It is the type of head found in all high-yielding fields and for these reasons—which are sufficient—the seed of such heads should be sought for planting."

Farmers' Idea of Seed Head. J. J. Johnson, the Butler County kafir grower, summarizes briefly as follows:

"In selecting heads for seed I want a symmetrical, cylindrical head that bulges in the center; not spreading, but compact; not the unusually heavy head, but of medium weight and size, with full plump grains, and with a stem that's out of the boot."

Score Card Value for Kafir Heads. For years a score card has been used in judging corn, but not until recently has one been designed for judging the heads of kafir. While the score card is most frequently used by

the expert judge in passing upon the merits of competing samples in agricultural exhibits, nevertheless it has a practical value to the farmer. By comparing the specimen in hand, with the card, he is able to know how near the head approaches the ideal sought and in what particular respect it is lacking. So it is worth while to know the requirements for kafir, and here is a card which was first printed by the Oklahoma Farm Journal:

	Score, Points
Uniformity.—Heads should be uniform in shape, size and type	10
Structure.—The center stem should be at least three-fourths as long as the head. Seed stem sections should occur at regular intervals—not less than five in number—even distribution, uniformity in length, and close setting of the joints on the seed stems being desirable	20
Development.—Head must be pushed clear out of boot	5
Color.—Large white grain with pink speck on tip	5
Size of Grain.—The larger the grain the better, if it does not shatter	10
Market Condition.—Sound, firm and mature	10
Length of Head.—Eleven to thirteen inches	10
Circumference.—Seven to nine inches	5
Base.—First seed stems not too long, thickly set and well filled close up to the main stem. An open base is undesirable	5
Tip.—Not too tapering and well filled with sound and uniform kernels. Tip seed stems should not be more than one-fourth as long as the head	5
Seed Stem Branches.—Well proportioned to length and size of head, no open spaces, each place for a seed being filled	10
Shattering.—Should not shatter easily in handling	5
Total score	100

At "Structure" in the score card it is stated that the center stem "should be at least three-fourths as long as the head." This is intended, undoubtedly, as the minimum requirement. I would urge the grower, in selecting heads, to specially note the length of the center stem and select such heads as have the stem extending well toward the tip. A long, strong center stem is the most important indication of a high-yielding head.

The "Color" requirement in the score card is for black-hulled kafir; this will vary, of course, with the variety of kafir grown, and the color of seed and glumes should conform to the description given on page 51.

Size and Shape of Grain Sorghum Heads. "Each of the grain sorghums has a desirable standard size and shape," writes A. C. Hartenbower, of the Stillwater, Oklahoma, Agricultural Experiment Station, in the Breeders' Gazette. "The heads of the kafirs should be cylindrical and taper very slightly at base and tip. They should be about eleven inches in length and nearly eight inches in circumference at the center. Milo heads should be ovate, tapering very slightly at base and tip. The length should be about six inches and the circumference at center about seven inches. Feterita, or Sudan durra, should have cylindrical, strongly tapering heads at base and tip. The length should be about nine inches and the circumference at center about seven inches."

Well-Bred Kafir Stalks. When selecting seed heads of kafir as much attention should be given to the type of stalk as to the type of head. The stalks of well-bred kafir might be called heavy set, bearing no suckers or side shoots, and of even height, producing heads uniform in shape and size. The joints should be short with a pair of large leaves growing from each. This type of stalk makes the most fodder or silage. It is the vigorous, hardy type which resists the winds and dry weather and which gives the grower the most certain and greatest return, and, if possible, seed heads should be selected from stalks having these characteristics of good breeding.

I have seen hundreds of fields in Kansas and Oklahoma in which not a single stalk of this type grew and from which fields not one desirable seed head could be obtained. See the illustration on page 158. It will prove a waste of time and energy to seek seed in such fields. Much better seed can easily be obtained elsewhere and by so doing several years can be saved in the grading up process.

Selecting Seed Heads in the Field. On nearly every page in this book reference has been made to the desirability of early maturity in grain sorghums. If the earliest-maturing heads and those borne on the true type of stalk are to be obtained for seed, they must be selected in the field before any of the heads have fully matured. By the time the earliest heads can safely be gathered for seed, they will be indistinguishable from other heads maturing a week or ten days later. It is advisable to mark four or five times as many heads as may be needed for seed the following season. This, because in the field proper attention cannot be given to head characteristics and in the final selection many of those heads may be rejected. The marking is most conveniently done by tying a bit of bright-colored rag around the stalks just below the heads. This method of marking will attract attention to the heads when they are ready for gathering.

Do not select heads from stalks growing in the outside rows or to themselves in the turning row. Such stalks have had more than their proportion of moisture and so have not grown under the more trying conditions of plants at regular intervals in the row. But if four or five stalks should be found growing closer together than usual and of these one or two have produced heads of proper type, these heads will be desirable seed. Such stalks show unusual vitality and ability to produce grain under unfavorable conditions. Do not select the largest heads of the field. These usually grow on the over-sized stalks. The large stalks use more water than the smaller stalks and economy in the use of the soil's moisture should be

kept in mind. A good rule is to select the largest heads from the smallest or medium-sized stalks. Select only those heads which have exserted themselves from the boot.

After the marked heads have fully matured they should be gathered. It is not a big job to ride a muzzled horse through the field, cut the heads off with a knife and place them in a sack fastened to the saddle. If the crop is to be harvested by hand soon after maturity and before the heads are exposed to wet or freezing weather, the selected heads may be gathered at the same time and placed in a box attached to the wagon. If it is worth while to plant good seed it is well worth the time necessary to properly gather it, and it is dangerous to delay until the crop is harvested.

Final Selection of Seed Heads. The work of making the last critical examination to decide upon the best seed heads should be done under convenient circumstances and at a time when it need not be hurried. It is now that the kafir grower will begin to learn things he has not dreamed. He will study shape, structure, and weight of head, and will observe the result of variation from the true type. He should have the score card before him and by his side the kitchen scales which will weigh accurately by ounces. An intelligent use of the scales will reveal surprises in weight of heads of different conformation.

For making this selection, a table of convenient size should be provided. Two boards, each a foot wide and twelve to sixteen feet long, placed across two barrels or boxes, answer the purpose well. Place 100 heads on nearest board and begin the final selection. Throw aside such heads as do not meet the standard in mind. Lay on the farther side of the table those that meet or come near meeting the standard; go over the first selection a second time, being more exacting in the requirements, and finally determining upon the heads the seed of which will be used for the following season's planting.

Hold the selected seed in the heads until ready to plant. There is danger of damage to the seed if threshed and held even in small quantities. At planting time the weather is warm and conditions are extremely favorable to heating. This instance well illustrates the point:

A farmer in Southern Kansas bought choice kafir seed and tested it just before planting. It germinated well. He planted part of a large field, when further planting was delayed on account of rain. He stored the unplanted seed in bags in his residence. In about a week the remainder of the field was planted. The seed planted before the rain gave a full stand, while that planted after the rain did not give one-fourth of a stand. Although kept in a dry room, it absorbed enough moisture to make it heat sufficiently to destroy its germinating powers.

Care of Seed Heads. The heads selected for seed should be stored in a dry, ventilated place. Each individual head should be suspended with the tip hanging downward, and the heads should not be permitted to touch each other. Thorough drying is to be accomplished and molding and heating prevented. If the heads are tied in bunches of four or five or placed in sacks, there is danger of damage to the seed of that part of the head through which the air cannot circulate. If four or five times as many heads as are necessary for seed have been gathered, the job of properly storing is much greater than if the final selection is made immediately after gathering. Immediate final selection is to be recommended and it is the part of wisdom to save enough heads to replant or for use another year in case the seed planted is lost.

It requires no more time to do a job in season than out of season, and when the importance of good seed is considered it is apparent that time from other work can better be sacrificed than that necessary to properly select and store the seed upon which the next year's crop is dependent.

Threshing Seed Heads. The removal of the seed from the heads selected for planting, should not be done by threshing machinery because of the possibility of mixing with seeds of other sorghums. The head may be rapidly and otherwise satisfactorily "shelled" or threshed by beating against a board. The largest and best seed will fall off the head first. To completely shell the head will result in more or less small and inferior seed being planted. It has been suggested that the seed be removed by the use of a curry-comb, laying the head on a short board, the lower end of which rests in a wash tub or box, and scratching off about one-half the seed.

Whatever the method of threshing, the seed should be fanned and the broken kernels and chaff removed. A good fanning mill is a handy and important farm implement—not alone for cleaning the seed of kafir, but that of all other crops. Where no fanning mill is available, the seed may be cleaned by throwing it into the air and allowing the wind to blow out the lightest seeds and chaff.

Testing for Germination. Before removing the seed from the selected heads, it is well to test for germination. By this means those heads showing highest germination and greatest vitality can be used for seed. However, it has been my experience that the seed from well matured and well cared for heads will germinate almost perfectly and grow vigorously. If seed from the bin is to be planted, it should by all means be tested. Such a small percentage may grow or the germination be so weak, that it would be unfit for planting. At any rate, by knowing the per cent of germination the amount of seed to be planted per acre can be better determined.

A Kansas Farmer subscriber writes: "It is even more necessary to test kafir than corn, because much more kafir is spoiled in handling and there is also danger of heating that makes kafir unfit for planting."

A convenient method of making the germination test is as follows: Place two or three thicknesses of muslin or other cloth in a dinner plate or pie pan. Place the

seed thereon and cover with two or three more thicknesses of cloth. Wet the seed and cloths with water not colder than that from a well or cistern. Cover the plate or pan containing the seed, with an inverted plate or pan, to prevent moisture evaporation. A plate or pie pan of ordinary size will accommodate three hundred seeds.

If planting seed which has been stored in bags or bins, be sure that the seed tested represents an average condition of that which will be planted. This can be accomplished only by thorough mixing of the seed. For example, if the grower desires to plant two bushels of seed from a bin of 100 bushels, he should select the two bushels, place in a pile on a clean floor and mix thoroughly by shoveling. After this is done take from any part of the pile the quantity of seed to be tested and the results will prove a good index to the germination of the seed to be planted. If seed from individual heads is to be tested, then the seed of each head must be kept separate in order that the germination results may be identified with the head. In this event the seed must be placed on white cloth that it may be marked into squares, and each square numbered to correspond to the number placed on the head. Ten seeds taken from different parts of the head, will give a sufficiently accurate test.

The seed should be kept sufficiently moist to grow, and in a place of even temperature—but not too warm; fifty to fifty-five degrees is about right. This comparatively low growing temperature will better test the vigor of the seed than will a higher temperature. Kafir which shows good germination at these temperatures is likely to have the vitality to withstand early seasonal adversities and can be planted earlier than seed which requires a higher temperature for germination.

From the above suggested method many variations may be made. The instructions are intended only to indicate the principle. Several thicknesses of newspaper may be used instead of cloth. Bread pans or other shal-

low pans may be used in the place of plates or pie pans. More than one layer of seed can be tested in the same receptacle by using more layers of cloth with seed between them. Sawdust, dirt or sand should not be used for germinating seed unless a thickness of cloth or paper is placed between this and the seed so that the root growth may be observed.

A germination test of any seed is interesting and instructive. The variation in the germination will be surprising. Some seeds will grow large roots and comparatively small sprouts, others large sprouts and small roots. Some seeds will grow much more rapidly than others.

The Seed Plat. Recently a farmer who plants not less than two hundred acres of kafir each year, told me he desired to improve his kafir but that the selection of heads for planting his acreage was too big a job for him to personally undertake.

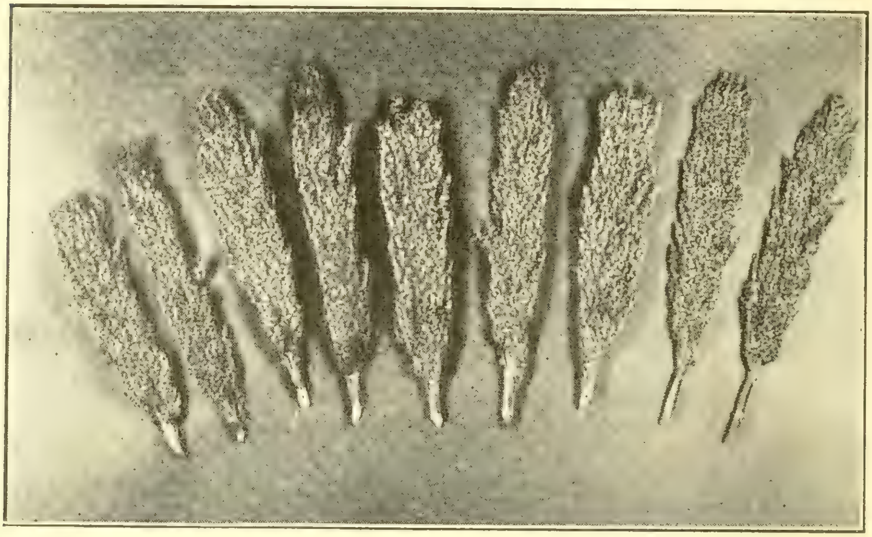
For such growers the seed plat would prove the ideal means of securing better seed for field planting. This would involve the selection of enough choice heads to plant an acre, from which the best heads should be gathered for planting another seed plat the following year. The general run of heads from the seed plat may be used for field planting. By this method the seed can be greatly improved and the labor reduced to a minimum.

The seed plat is also recommended to the small grower who can secure only a limited number of choice heads. The plat should be isolated from other fields of sorghums in order to prevent mixing by cross-fertilization.

Performance of African Seed. Another most excellent example of the advantages of inherent early maturity and dry weather evasion and resistance, is given by the performance of seed imported from Africa and planted in Osage County, Kansas, in the spring of 1913. This seed matured grain in advance of frost, and while the yield was undoubtedly reduced because of dry weather, the 30 to 35 bushels of mature seed per acre, produced in

a year of extreme growing adversity, renews hope in the future usefulness of kafir if its utility is maintained.

The seed from Africa produced two types of heads—about 80 per cent like those shown in the illustration on this page, and 20 per cent like those shown in the illustration on page 188. The latter heads were extremely compact and the heads I gathered for photographing



Kafir Heads Grown in 1913 from Seed Imported That Spring from Africa.—Each of These Heads Has the Interior Construction Shown on Page 236.

were moldy in the center and a considerable proportion of the seed damaged. The heads of true kafir type had been exposed to the same rainfall but were in perfect condition. The heads shown on this page were gathered on August 15 and the seed was planted June 1, as represented by the grower, and which is evidence of the early maturity and hardiness of the imported seed. These heads conform to the structural characteristics of the high-yielding head shown in picture on page 236.

It is unfortunate that the particular section of Africa from which this seed came is not known in order that the seasonal conditions might be ascertained. But it is certain that this seed was grown under and thoroughly

acclimated to conditions at least as severe as those which prevailed in Osage County, Kansas, in 1913. The performance of this seed was such as should establish the adaptability of kafir to extreme conditions and the necessity for maintaining the inherent dry weather evasion and resistance of well-bred seed.

The three heads in picture on page 188, were also from African seed planted in Southeastern Colorado in the spring of 1913. While these heads do not conform to the high yielding type of kafir, they possessed the hardiness necessary to make a crop without rain in measurable quantities during the growing season. The grower stated that three showers—not enough to lay the dust in the field—fell from the time of planting until after maturity.

On the Importation of Seed. Immediately following an illustrated article in Kansas Farmer regarding the showing made by the seed imported into Osage County, Kansas, those interested in kafir improvement began inquiring about the advisability of the importation of seed in large quantities for distribution throughout Kansas. Many inquiries of such character were referred to me. I held that if imported seed could be obtained which would be as satisfactory in every respect as that obtained by the Osage City people, it would be a better foundation from which to develop an early-maturing, dry weather-resisting strain of good head type than the kafir now generally grown in Kansas. But there could be no guarantee of securing reasonably pure seed from a section of Africa having seasonal conditions similar to those prevailing here, except by personal familiarity with all conditions. To depend upon African exporters would most likely be disastrous.

In the search for suitable feed, the Kansas Bankers' Association was offered kafir seed from East India. Investigation revealed that the section in which the offered seed was grown, has an average annual rainfall of 60 inches and growing temperatures prevail throughout the year. The use of seed grown under such conditions would

in all probability result in failure in Kansas, Oklahoma or Texas. So, aside from the purity of the seed, the conditions under which it is grown are important in estimating the value of imported seed. Africa is a large country with widely varying climatic conditions and fortunately the seed obtained for Osage County came from a section the seasonal conditions of which are similar to those which prevailed in Osage County in 1913. The success of future importations will depend upon securing seed of reasonable purity and which has been grown under conditions similar to those under which it will be grown in this country. Certainly the importation of seed without full knowledge of all the contingent conditions is not to be recommended.

The seed of kafir now grown in this country was originally secured from South Africa by the Federal Department of Agriculture. The several strains were acclimated and improved before being given to the farming public. The experiment stations of the sorghum belt have perpetuated these strains and have sufficient seed of pure kafir to meet the requirements of the station farms. It is to be hoped that such stations may be interested in increasing the production of such seed to the point that kafir growers may obtain it for seeding small plats and in a few years have sufficient for general field planting. The stations of Kansas, Oklahoma, Texas, Colorado and New Mexico, could do no more important work than distribute pure strains of the several grain sorghums in sufficient quantities to ultimately replace the low-yielding seed now generally prevailing.

The wide awake farmer who will develop pure or near pure strains of good head type, can have a market for seed which will pay as well or better than any other crop he can grow. It would have required several thousand bushels of seed to supply those who made inquiry of me in the springs of 1913 and 1914 for the seed of high-yielding heads. Seedsmen supplying the grain sorghum belt can well afford to develop high grade seed of the

several sorghums, thereby making good business for themselves and doing the sorghum belt farmer a real service.

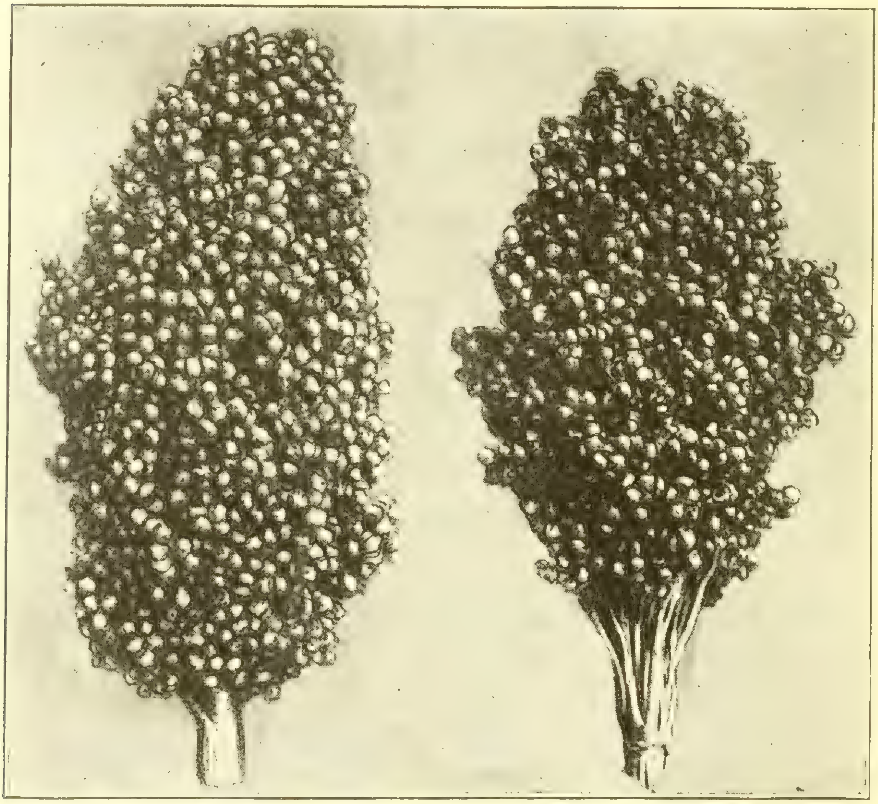
Choice Kafir Only Spring Crop. A Lincoln County, Kansas, subscriber writes: "I greatly appreciated your kafir article in March, 1913 issue of Kansas Farmer. I make kafir my sole spring crop and have had most excellent success. I hand pick the seed heads of heavy yielding and ideal type." This subscriber sold several hundred bushels of kafir seed in the head during the spring of 1913.

Another Kansas Farmer subscriber wrote on March 22, 1913: "I would be willing to give one dollar, or even more, for ten or twelve pounds of seed in the head, of high-yielding kafir. I am desirous of starting on my farm, kafir that is pure and true to this type. I am anxious to find something in the line of kafir that does better than eighteen to twenty bushels to the acre."

Conclusions Regarding Head Type. The conclusions regarding the high and low-yielding types of kafir heads were reached as a result of close examination of many fields. While I was seeking the cause of low yields in Kansas, H. M. Cottrell, John Fields and George Bishop were pursuing the same line of investigation in all sections of Oklahoma. While my work was wholly independent of theirs, a comparison of notes revealed a unanimity of opinion. So, what is written in this chapter on the relation of type of kafir head to yield is the result of investigations throughout Kansas and Oklahoma and it is my conviction that the conclusions may be regarded as agreeing with the facts.

I feel supported in these conclusions by Carleton Ball, agronomist in charge of the grain sorghum investigations for the Federal Department of Agriculture, who, in a bulletin on "Better Grain Sorghums," illustrates desirable types of kafir and milo heads and which conform to those types here shown. He says that filling of these sorghum heads at the tips and butts is fully as impor-

tant as the filling of the corn ear, and that "less attention has been given to this matter than it deserves." Thus he takes cognizance of head type and its relation to the yield. While Ball does not show the interior of the desirable heads illustrated by him, it is certain that the type of kafir and milo head he recommends for seed has the interior structure here shown.



On Left is Desirable Form of Milo Head and on Right Undesirable Form.—From U. S. Department of Agriculture Bulletin 448.

In every field of high yields the high-yielding head is the prevailing type, and this is believed to be the true type of pure kafir. It is the type first grown in Kansas and that preserved by an occasional grower through all the years since its introduction. It is a type of head identical with 80 per cent of those produced in fields

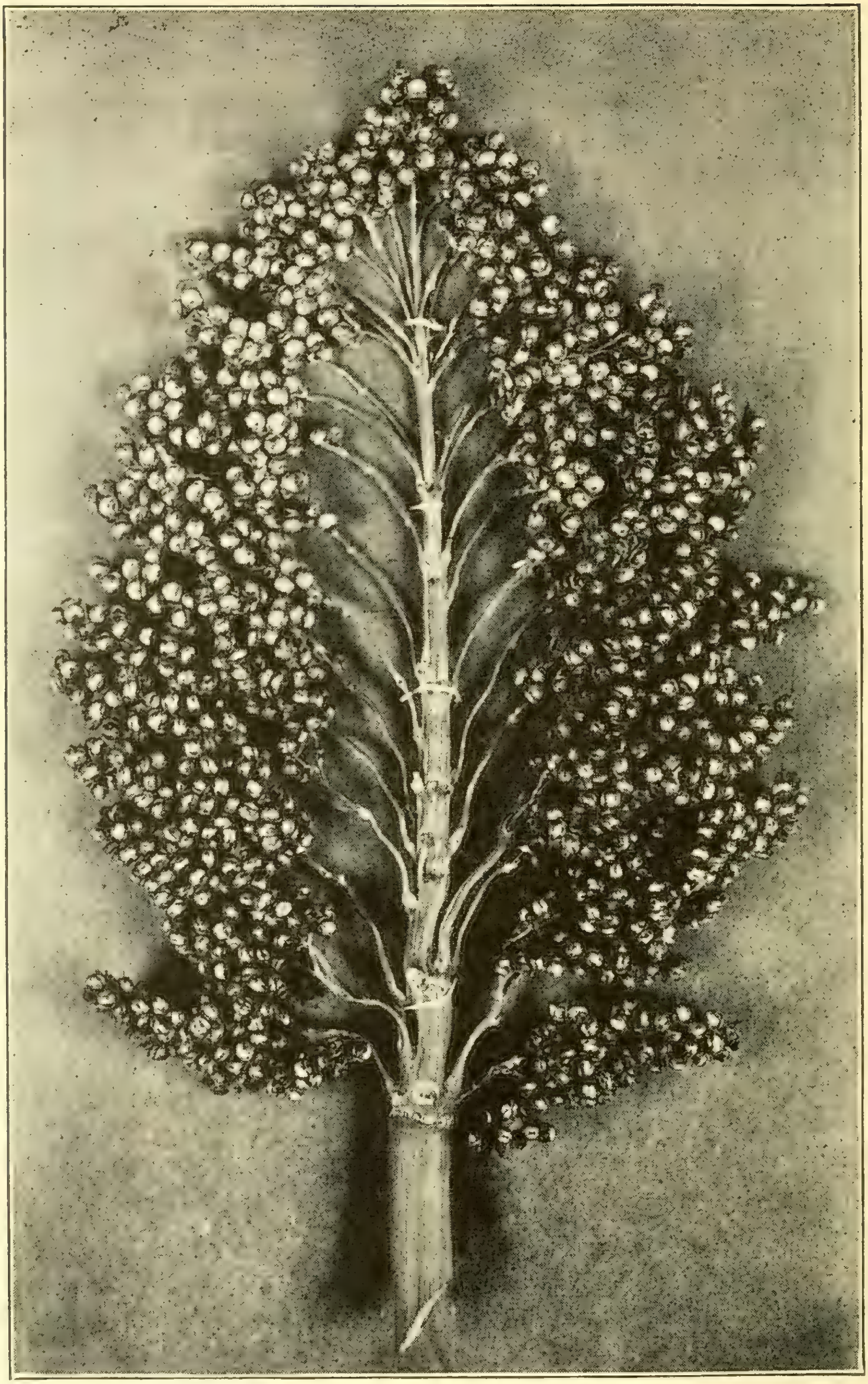
planted in Osage County, Kansas, in 1913, from seed imported in that year from Africa.

The type of head has more far-reaching effect than the amount of seed it carries. Wherever the high-yielding type of head is found it possesses the hardiness necessary to withstand dry weather, and if kept of early maturity will evade dry weather. By planting seed from such heads the grower has greater crop assurance in addition to higher yield than if seed from the low-yielding heads is planted. There is a relation existing between the head type and crop assurance which is well worth observing.

Milo and Feterita Head Type. Those general principles of head construction which distinguish the head of pure and high-yielding kafir, seem to apply with equal significance to both milo and feterita. The similarity of interior head structure will be observed by comparing the illustrations on pages 236, 254, and 258.

The milo heads illustrated on page 148 are typical heads of well-bred milo from early-maturing fields which yielded well under the seasonal adversities of 1913. In that year I failed to find an early-planted, well-cultivated field of improved and selected milo which did not produce grain. The dissected head on page 254 measured eight inches in length and weighed six ounces. The seed was fully matured and every glume on the head filled. In handling, this and its companion heads held their seed remarkably well.

The heads of feterita or Sudan durra shown on page 260 are of the desirable type and are typical of the heaviest heads in the highest-yielding fields I have seen. These heads were grown in 1913 in Cheyenne County, Kansas, and the yield was thirty bushels per acre. This field did not sucker badly and the heads shown are from main stems only. Those heads of feterita shown at the agricultural fairs in Kansas and Oklahoma in 1913 were widely varying in type—a thing quite generally noticed and commented upon by farmers. The fact is that much


Interior of Dwarf Milo Head of Desirable Form.—Compare with Illustration on Page 236.

feterita, so-called, is white durra, which has been grown off and on for years throughout the sorghum belt under the names of "Egyptian corn," "rice corn," and "Jerusalem corn." The seed of white durra is near white, with light-colored hulls, the heads are more slender and pointed at the tip and butt and not so bunchy as those of Sudan durra. The seed of Sudan durra or feterita is larger than that of white durra, is white with a slightly bluish tinge, and has dark brown hulls. The heads of white durra have a tendency to droop, while feterita has naturally erect heads. Thousands of bushels of the seed of white durra was sold as feterita in 1913. Remembering these differences and observing the type of feterita head here shown, the grower cannot be mistaken in distinguishing white durra from feterita if he can see the seed in the head.

The dissected feterita head shown on page 258 measured seven inches in length and weighed three ounces. The picture shows that the specimen shattered badly in handling and the vacant glumes appearing in the illustration are from this cause. The head was completely filled with mature seed when harvested. In outward appearance and interior construction it was uniform with the ten heads shown on page 260.

It should be observed that the heads of both milo and feterita have the same sturdy center stem found in well-bred kafir. The joints from which the seed-bearing stems grow are closer together than those of kafir and it will also be noted that an occasional seed stem grows between the joints. This latter characteristic seems to prevail quite generally in the heads of these two sorghums. The seed stems do not produce seed their full length as in the case of kafir, accounting in part for a shape of head differing from that of kafir. It should be noted, too, that the heads of well-bred milo and feterita are compact and heavily seeded, with no suggestion of the open, loose head of cane or broomcorn.

Select Seed of Milo in the Field. Field selection is more important in the case of milo than in kafir, because the characteristics of improved milo have not yet been so firmly fixed as those of kafir. Milo has the same tendency to mix by cross-fertilization with other sorghums, as has kafir. In every field there are heads which mature one to two weeks earlier than others. Milo is also inclined to mature late unless its earliness is maintained by planting the seed of early-maturing heads. It heats in the bin as readily as does kafir and the germination of the seed is equally affected. Therefore, it will be seen that the same tendencies to degeneration and a diminishing usefulness of the crop, exist in milo as in kafir. The stalks of unimproved milo are varying in height, ranging from four to seven feet, the heads are pendent or "goose-necked," and the plant naturally stools and branches prolificly. See page 161.

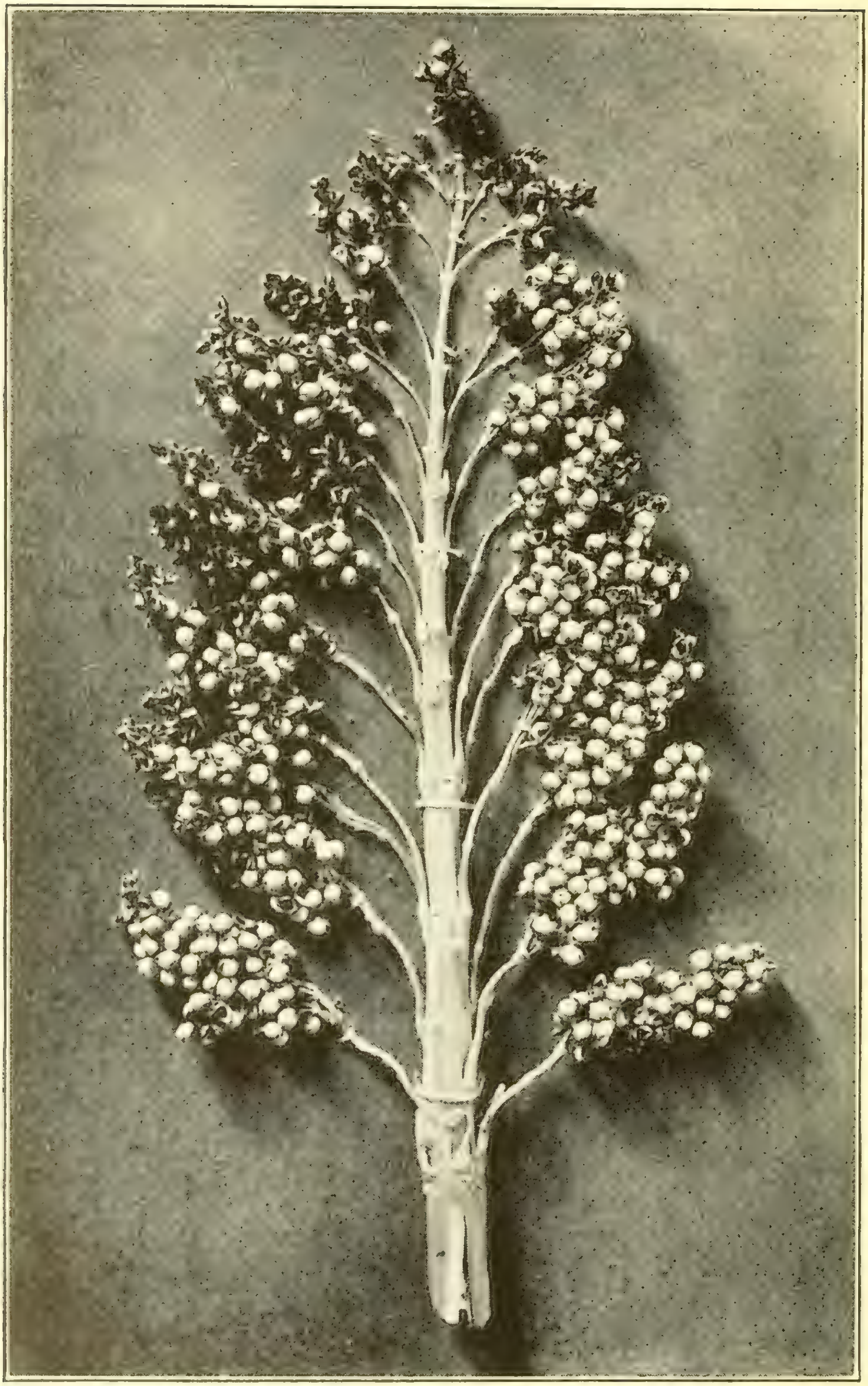
There was a time when some value was placed on the sucker. This, because in favorable growing seasons the sucker would produce a head and it was believed the grain yield was thus increased. However, the sucker grows at varying heights, and the head is usually small and ripens later than the main head. The power to "produce several stalks from one seed" is no longer regarded as an economy in grain sorghum production. Seed is plentiful and cheap and there is no advantage from this standpoint. On the other hand, the suckers make an additional and unknown draft on the soil moisture, using that which the main stalk frequently needs to mature seed, undoubtedly having much to do with delaying the maturity of the seed on the main stalk. In growing milo for grain, it may be said that suckering is a serious objection. For forage, when a heavy crop of leaves and stems is desired, suckering may be advantageous, but this can be most satisfactorily offset by thicker planting. Branching from the joints of the stalk is equally objectionable and for the same reasons. While suckering is a normal characteristic of some sorghums,

branching seems more or less dependent upon weather conditions and is most noticeable in a year of abundant rainfall during the late growing season.

The varying height of stalks and "goose-necked" head are seriously objectionable from a harvesting standpoint. They make heading by machinery almost impossible and even hand-heading difficult. On account of these features harvesting with the corn binder is unsatisfactory, because the crooked heads prevent the stalks from lying parallel in the bundle, and furthermore they make the top of the bundle larger than the butt and so it is impossible to build a shock which will protect the grain and forage from the weather. The crooked stem interferes with feeding the head whole and greatly interferes with grinding.

These objectionable habits have to a great extent been overcome by the Federal Department of Agriculture in establishing several "improved" milos. One of these is the common yellow milo which has been selected for uniform height and without suckers or branches. This grows to a height of four to four and one-half feet at elevations of three to four thousand feet. The other is a dwarf milo growing three to three and one-half feet at the same altitudes. In these strains branching has been almost entirely overcome, stooling has been greatly checked and 75 to 90 per cent of the heads are upright and the remaining 10 to 25 per cent are not inclined more than thirty degrees, which is about one-sixth that of the pendent heads. The improved varieties, therefore, can be headed by machinery and even bound into well formed bundles. The accomplishments of the Federal Department of Agriculture in milo selection is a worthy example of the usefulness of that department in improving farm crops.

Selection by the grower to further overcome these objections and develop strains far removed from these natural tendencies, is desirable. Select erect, well filled, early-maturing milo heads of the type illustrated, from



Interior of Head of Feterita or Sudan Durra.—Compare With Illustration on Page 236.

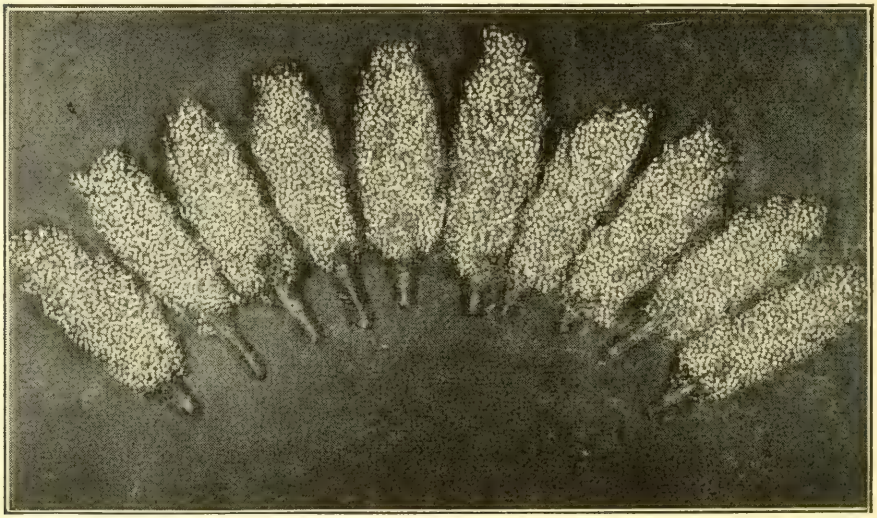
stalks of medium height and which have no suckers or branches. To be able to do this the grower must select them in the field. The yield and value of the milo crop largely depends upon the selection of good seed and such care until planting time as has been described for kafir.

Field Selection of Feterita. In its habits of growth, feterita or Sudan durra is very similar to milo, although its heads are naturally erect. The stalks are slender and vary in height from four to seven feet, and under favorable growing conditions the plant suckers and branches abundantly. Suckering or branching with feterita is largely dependent upon seasonal or soil conditions and in this respect it differs from milo. As evidence of the variability of feterita in that respect, some Kansas growers in 1913 reported that the crop did not sucker or branch at all, others that it branched but did not sucker, and vice versa, while others reported that the crop both suckered and branched.

These habits are more or less characteristic of milo and in the case of that crop have largely been eliminated by selection. This was regarded as necessary because of their disadvantages. If such habits are objectionable in milo they are also objectionable in feterita and consequently there are the same good reasons for eliminating them. To accomplish this, then, field selection of the seed head is necessary.

The selection of feterita seed heads should be made so soon as the first heads mature. This is to maintain its present early maturity and so continue dry weather evasion. The seed heads should be taken only from the main stalk. Select heads from erect stalks which have no branches or suckers, or from stalks which have the smallest number of each. Select heads which are well filled at the tip and butt and which in outward appearance and interior construction conform to the heads here illustrated. The same precaution should be taken to prevent mixing with other sorghums as in the case of kafir or milo.

Field Selection of Cane Seed. It should be remembered that field selection of cane, when grown either for seed for market or for forage, is fully as essential for the most satisfactory crops as is such selection of the grain sorghums. The selection and care of cane seed is identical with that already recommended for the other sorghums. The advantages of pure strains of cane are given on page 159.



Heads of Feterita or Sudan Durra.—More Desirable Than Heads More Pointed at Tip and Butt.—Each Has Interior Shown on Page 258.

Percentage of Grain to Total Crop. As would be expected in grain sorghums, the percentage of grain to total crop will vary with the season in which the crop is grown and with the stand. Investigation at the Texas forage crops stations indicates that under ordinary field conditions milo will produce 35 to 40 per cent of grain to total weight. Black-hulled kafir averages about 25 per cent; the lower percentage in kafir is due to the heavier stalk and the greater number of leaves as compared with milo. A plat of feterita at the Chillicothe, Texas, station in 1912, yielded 35 per cent of grain. The heads of milo, feterita and kafir will thresh out about the same per-

centage of grain, which will range from 75 to 80 per cent of the total weight. In seasons of dry weather or other unfavorable conditions for grain yield, the percentages may fall to one-half or less of the above averages.

Home-Grown Acclimated Seed. It should always be kept in mind that home-grown, acclimated seed will give the best cropping results. Select home-grown seed of sorghums whenever this is possible. Reference to the map on page 146 will reveal the variation in annual precipitation and length of growing season throughout the sorghum belt. Elsewhere it is shown in detail why it is unwise to move seed from the area of 200 days of growing season in Texas or Oklahoma to Northwest Kansas where the growing season is 140 days. Neither would it be an act of wisdom to move seed from Southeast Kansas —where the annual precipitation is 45 inches and the growing season 190 days—to Southwest Kansas where the annual precipitation is less than 20 inches, even though the growing season is only 10 to 20 days shorter.

In every comparison of seed value, acclimated seed has given the greatest crop assurance and the best yields. If it is necessary to import seed of sorghums it should be obtained from a section of shorter growing season and of less precipitation than that in which it is to be grown. Secure the best obtainable seed near home for the general crop. If such seed is not satisfactory as a basis for improvement through selection, and it is necessary to import seed grown under climatic conditions widely varying from those in which it is to be planted, then obtain only sufficient for planting a seed plat of an acre or two and thus acclimate and produce the seed necessary for field planting two or three seasons hence.

Is It "Too Much Trouble"? I have heard time and again that "it is too much trouble" to select the seed of field crops in the field, properly store the seed during the winter and test in the spring for germination. But the farmer's principal business is that of growing crops for market or for maintaining and fattening his

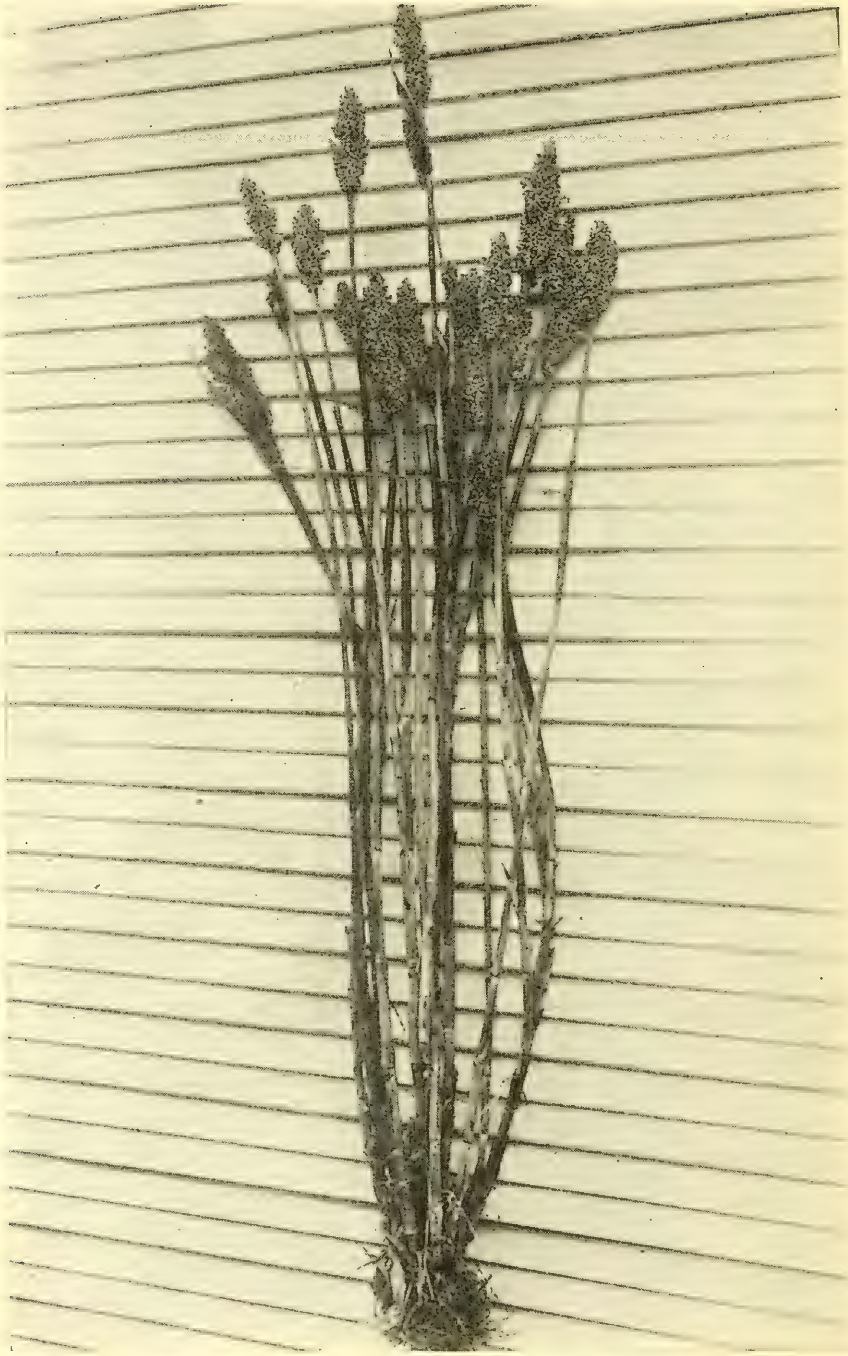
live stock. His success as a farmer is dependent upon what he can produce in the way of crops from his fields. Then, what is more important than good seed? Many good farmers have found that good seed not only gives the highest yields but the greatest crop assurance. Herein is printed the evidence from many farmers, showing that seed selection has paid them. It is altogether probable that it will pay other farmers as well.

I am confident that a half day spent in selecting and marking seed heads of kafir, milo or feterita, another half day spent in gathering the heads, and a day, if necessary, expended in making the final selection and stringing the heads for winter storage, will be all the time needed to carefully select all the seed the quarter section farmer will need for his own use and a small increase in bushel yield will pay big returns on this expenditure of labor. The sorghum belt needs surer crops. The grain sorghums are the most certain now known. They should be maintained and in fact improved to the highest degree of usefulness and dependability.

Feterita Recent Importation. Feterita or Sudan durra is the most recent importation of useful grain sorghums. It has been tested by the Federal Department of Agriculture at its Texas forage crops stations for a period of only six years, and at which stations its yield has not exceeded that of other grain sorghums. For three years only has it been grown on any considerable acreage by the farmers of Texas and Southern Oklahoma, and in Kansas only on a small acreage during 1913. In 1911 in Northern Texas it gave good grain yields when kafir and milo both failed, and in 1913 in Kansas it gave satisfactory yields on farms on which kafir and milo failed to produce grain. However, in every section of Kansas there were satisfactory yields of both milo and kafir, while generally both were failures. This condition will always prevail—just as in the best corn year there are some failures—not due to the inadaptability of corn to the section, but to other reasons.

Promising Sorghum for Dry-Farmer. The performance of feterita during the past three or four years in the southwest section of the sorghum belt, and its 1913 performance farther north and east, has created unusual interest in the crop. It has already been stated that those who have carefully investigated the merits of feterita believe that its greatest usefulness will be confined to the areas of short growing season and about 16 inches or less of annual precipitation. This, on account of its early maturity and low moisture requirement—two essentials in such areas. In sections of greater precipitation its growing habits have a tendency to reduce its usefulness—principally through its suckering and branching, uneven ripening, falling and lodging, causing difficult harvesting and loss of grain. In other words, its habits are such as make it better adapted to the drier sections of the sorghum belt in which sections its objectionable features are minimized.

Judging from what I am able to learn regarding feterita and what I know of dwarf kafir and milo—the latter grown from pure, early-maturing strains and under such methods of cultivation as are essential in crop production—I believe that as the principal grain feed crop the usefulness of feterita will not be permanent east of the 100th meridian. West of that meridian and extending to the Rocky Mountains, in all probability it will become an important—if not the principal—sorghum grain crop. I am inclined to think that the area between the 98th and 100th meridians will be the eastern limit of feterita as a spring planted crop. As a secondary or catch crop, it will prove valuable on farms east of this limit and the Eastern Kansas and Eastern Oklahoma farmer who can follow early harvested crops with feterita will find it an important addition to his present short list of supplemental grain feed crops. It will prove valuable, too, when planted following loss of corn or kafir from bugs or other cause. Its early maturity will



Typical Feterita Plant.—These Stalks From One Seed.—Spread Was Near Four Feet Before Tying Together for Photographing.

also make it useful as an early grain feed for horses and hogs.

The value of feterita or any other crop cannot be established in a single year, especially when the seasonal conditions of that year are so extremely varying from the average or normal, as was the case in 1913. However, the disposition to give feterita a thorough trial is to be commended, but the reckless desertion of established crops for the new and untried, is to be discouraged.

Habits of Growth and Cultivation. The growing habits of feterita are described above in connection with the selection of the seed, and what is said regarding suckering and branching as applying to milo, is also true of feterita. It is a week earlier than pure dwarf milo and two or three weeks earlier than pure black-hulled kafir. In the sections of longer growing seasons and abundant rainfall the early planted crop will frequently mature and permit of head harvesting at a date which will permit the second crop of heads, but this is purely incidental. One crop of grain a year from one planting, will prove quite generally satisfactory.

The preparation of the ground, planting, cultivation, and harvesting of feterita is identical with that of other grain sorghums, except that the planting date should be somewhat later. Growers complain regarding poor stands of feterita, and these are probably largely due to early planting, provided, of course, the seed planted is mature and its germination not injured from heating or other causes. Such ordinary handling as is given the seed of kafir will seriously affect the germination of feterita. However, in dry seasons, thin stands prove the saving grace in the case of all farm crops.

Feterita at Hays, Kansas, Station. In 1911 feterita was planted at the Hays, Kansas, Agricultural Experiment Station. The following is reproduced from an article by Station Superintendent Helder, printed in Kansas Farmer in November 1913:

In 1911 the forage grew to a height of six feet, ma-

turing grain heads much earlier than other sorghums, the resulting yield being 16 bushels per acre. In 1912 feterita produced not to exceed 12 bushels of grain per acre with less forage growth than the previous year. Six acres were planted in 1913 on better land than that on which the former crop grew. With scarcely any measurable rainfall from the time it was planted until the forage began to dry up in September, the crop produced 18 bushels of grain per acre. After the grain was harvested the forage was placed in the silo.

Each plant of feterita will develop from four to eight seed heads which mature at different stages, making a complete harvest of the grain rather a protracted job. The grain has a great attraction for birds and owing to its softness they readily damage the heads during the different stages of growth.

Comparisons of feterita with other sorghums lead to the conclusion that it is not as desirable for roughage as is kafir or some varieties of saccharine sorghums. The forage is quite similar to milo but the stalks are taller than dwarf milo.

It is the opinion of the experiment station authorities thus far, that where kafir can be profitably grown it is preferable to feterita. The early-maturing ability of the latter should prompt its production in regions where the high altitude or light rainfall precludes the possibility of successful kafir production. The extreme western and northwestern counties of Kansas might profit by more attention to feterita and milo in the event kafir has not been found generally satisfactory.

The rainfall at the Hays station during April to August inclusive, has been: In 1911, 10.46 inches; 1912, 13.06 inches; 1913, 12.77 inches.

Federal Department of Agriculture on Feterita. For six years the Federal Department of Agriculture has tested feterita at its forage crops stations at Chillicothe and Amarillo, Texas. At the former station the annual

precipitation is 23 inches and at the latter 21 inches. Of these tests the department says:

"There is no satisfactory evidence that feterita is inherently more drouth-resistant than other grain sorghums. * * * It often happens that thin stands of feterita are caused by failure of seed to germinate, especially if planted while the ground is cold. Furthermore, the larger seed of feterita would give thinner stands if planted at the same rate as milo or kafir. At Amarillo, where feterita was grown under identical conditions as to stand, it showed no greater drouth resistance than milo or kafir.

"Experiments so far indicate that its earliness, its rather low water requirements, its satisfactory yields and the ease with which it may be harvested, give it a real place among the sorghums, either for grain or combined grain and forage purposes. No farmer should discard dwarf milo or dwarf kafir for feterita, however, until he has determined with certainty that on his farm it will outyield these staple crops when grown under identical conditions. The data at hand are limited, but they do not justify the claim that feterita will outyield dwarf milo."

The bushel yields per acre of feterita and dwarf milo at Amarillo for 1908-1912, inclusive, are given below. The rainfall, in inches, is for the period April to August inclusive:

	FETERITA	DWARF MILO	RAINFALL
1908	40.2	41.3	15.33
1909	9.3	11.0	10.80
1910	14.7	19.0	10.00
1911	34.2	37.6	15.66
1912	22.9	22.6	8.45
1913	No Grain	No Grain	7.90
Total	121.3 Bu.	131.5 Bu.	

Oklahoma Stations Report on Feterita. The Stillwater, Oklahoma, Agricultural Experiment Station and

sub-stations have been growing feterita several years. Summing up the observations made from all sources, the Stillwater station published this statement:

"In its present stage of improvement, feterita would not seem as desirable a grain crop as kafir or milo for most sections of Oklahoma. The fact that it stools badly and that it lodges easily and quickly after maturity seriously affects its value as a grain crop. For hogging down or for silage it would seem to rank high and even as good if not better than kafir or milo. In view of the limited information that we have we feel justified in recommending feterita only for the extreme northwestern parts of the state, or those sections where kafir cannot be grown successfully. It is our conclusion that even though feterita does produce a somewhat higher yield of grain than kafir, still its tendency to sucker and lodge makes it a less desirable crop for the general farmer whose principal aim is grain production."

Sorghums in Oklahoma Panhandle. The yields of grain and forage per acre of dwarf black-hulled kafir, dwarf milo and feterita for the years 1912 and 1913 at the Panhandle State School of Agriculture, Goodwell, Oklahoma, are here given: In 1912, kafir yielded 56 bushels of grain and 10 tons of forage; milo 72 bushels and 5 tons; feterita 48 bushels and 4½ tons. In 1913, kafir yielded 32 bushels and 10 tons; milo 28 bushels and 4 tons; feterita 18 bushels and 2 tons. The 1912 rainfall at Goodwell was 22 inches, while the normal rainfall is 17. Kafir required 85 to 86 days to mature; milo 80 to 82, and feterita 80 to 85 days.

"Feterita will be a valuable crop for the Panhandle farmer," says President Black of the School of Agriculture. "I do not believe it should be planted to the exclusion of milo and kafir. It is a strong grower and will mature well within the 90-day limit. The grain is soft and starchy and will rot if planted when the ground is cold and wet. Feterita may be cut and fed green to cattle, hogs and horses when pastures get dry in the fall.

I believe the Panhandle farmer should not plant to exceed 20 acres of feterita on a 160-acre farm. But if it is desired to fill the silo with an early crop a larger acreage may be planted."

Sorghums in New Mexico. At the Tucumcari, New Mexico, Agricultural Experiment Station, with two and one-half inches of rainfall badly distributed through the growing season, feterita yielded 15.8 bushels of grain per acre and 2,175 pounds of forage; dwarf yellow milo yielded 13.3 bushels and 2,190 pounds of forage; standard yellow milo yielded 5.8 bushels and 1,172 pounds of forage; and kafir yielded 4.3 bushels and 2,027 pounds of forage. The feterita was planted May 28 on land plowed four inches deep, but owing to a poor stand was replanted June 9 in rows 3 feet 8 inches apart and thinned to 10 inches in the row. Tucumcari has an annual precipitation of 17 inches.

Professor Mundell who has conducted the grain sorghum tests at that station, believes that feterita is of great importance for the dry land farmer. He says that a good yield of grain and fodder or silage can be counted on every year if the ground is properly prepared in the fall or winter and if the crop receives proper cultivation. He ranks the three important grain sorghums as follows: Dwarf yellow milo for grain; black-hulled kafir for fodder or silage; feterita for either grain or fodder or both.

Feterita in Wilson County, Kansas. Here is the view of H. M. Hill of Wilson County, Kansas, and which section has 35 to 40 inches of annual precipitation and a growing season of 190 days. He emphasizes the use of feterita as a catch crop following oats or other early harvested crops:

"In 1913 I planted one small field of feterita on June 28 after a crop of rye had been taken off the land. We had half an inch of rain on July 10, which was all until this crop was made. The crop was matured September 15 and all the kafir in this section was killed by frost before it had matured. This feterita made 55 bushels to

the acre. I put most of this crop in the silo and it made excellent silage.

"I am convinced of two important precautions which should be heeded by growers of feterita: (1) do not plant too early, and (2) do not plant too deep."

"Hog-Down" Feterita. George Bishop of Washita County, Oklahoma, is in the area of 20 to 30 inches of annual precipitation and a growing season of 200 days and has grown feterita three years. He says:

"It is earlier than milo and its erect head makes it much easier to head by hand. It is as chinch bug-resistant as kafir, but will fall down as quick after maturity as milo. It will shatter badly if left long in the field after maturity. Its large grain and its early maturity make it a fine crop for early grain feed for hogs. Grow it and hog it down and you have it used for the best purpose I know. For a general grain feed crop it cannot take the place of black-hulled kafir or dwarf milo."

Kaoliangs New Grain Sorghum. A group of grain sorghums known as the kaoliangs, has within the past few years been introduced into the sorghum belt. This group is composed of a large assortment of early, late, dwarf, tall and otherwise widely differing varieties. Their place in sorghum belt agriculture has not yet been determined. The following paragraphs are taken from Bulletin 253 of the U. S. Department of Agriculture:

"They are of almost no value as forage owing to the dry stem and the few and small leaves. They are not likely to displace any of the leading groups of grain sorghums such as the milos, durras and kafirs now grown in this country. At the same time, on account of their earliness and perhaps greater hardiness, also, they have apparently a distinct place of their own to fill in the more northern and more elevated parts of the dry-farm areas."

. . . .

"Owing to their low water requirements and tendency to produce but one stalk from a seed, it has been possible

to mature good crops of kaoliangs in dry years where milo largely failed. If moisture is comparatively abundant in the early part of the growing period, milo is likely to put forth so many suckers as to seriously handicap the crop when dry weather sets in. The kaoliangs are less prolific in this regard and can therefore endure drouth more successfully. This fact gives value to the kaoliangs in the drier part of the Central Plains area. The kaoliangs seem also to be less susceptible to chinch bug injury than milos, though more so than the kafirs.

"At the forage crops station at Amarillo, Texas, one variety—Manchu brown—matured in 85 to 105 days in the years 1908 to 1911 inclusive, and the average yield per acre for these years was 17 bushels."

Sorghums and Chinch Bugs. There are no known sorghums proof against chinch bugs. All are affected more or less according to the varying juiciness of the stalk at the time of the attack. However, all sorghums have greater resisting and greater recuperative powers than has corn at corresponding stages of growth. An attack of chinch bugs that would totally destroy a crop of corn, might not destroy a crop of kafir, milo, feterita, or cane.

Sorghum Blight is Midge. The so-called blight of grain-producing sorghums is the work of the sorghum midge, an insect which lays its eggs inside the hull of the undeveloped seed at flowering time or soon after. The midge passes through all stages of its growth in fourteen to twenty days. This insect is more common in the southern section of the sorghum belt, although it has found its way as far north as Central Kansas. Its ravages are overcome by early or very late planting. In the San Antonio, Texas, region early varieties of sorghums planted March 15, made good yields. Plantings two weeks later made no grain.

Sorghum Smuts. The decreasing yields of kafir and cane the past few years have been largely due to increasing damage by grain and head smut. The first

attacks the kernels, and the second affects the entire head. It is believed that the normal loss in yield from these smuts is not less than 10 per cent of the grain crop.

The loss from grain smut can be almost wholly prevented by treating the seed with a solution of formalin consisting of one pound of 40 per cent commercial formalin to 30 gallons of water. The formalin is put up in pound bottles and costs from 50 to 75 cents per bottle. Put the seed to be planted, in a loose burlap bag and hang in the solution for one hour. Spread the seed on a clean floor which is free from smut, and shovel over and over until dry. The 30 gallons of solution will be sufficient for treating six bushels of seed, making the cost per bushel from 8 to 12 cents.

The treated seed should not be stored in bins or in bags infected with smut. It is also a good plan to wash the drill or planter box with the solution. It is well enough to test the seed after treatment to know that germination has not been affected.

It is a popular belief that head smut may be prevented by the same treatment. This belief is without foundation. If head smut is present in the field no seed should be saved from that field. The head smut resembles the smut of corn. It affects the entire head and is recognized by the irregular smut mass formed.

It is believed that no injury to live stock attends the feeding of smut-affected sorghums.

The head smut as above described, has never been found in milo.

The Army Worm. Some seasons considerable damage is done all grain sorghums by the fall army worm. The presence of this worm is indicated by drooping heads, being the result of the work of the worm in the stem just below the head and which weakened stem breaks off.

The Kafir Ant. Throughout the kafir-growing section the past few years a species of ant has been destructive to the seed of planted kafir. In the spring of 1912, J. W. McColloch of the entomological department of the Manhattan, Kansas, Agricultural Experiment Station, found that dipping the seed in commercial crude carbolic acid protected 90 per cent from the ravages of the ant. The ant ceases working when the seeds have germinated.

The seed must not be soaked or permitted to absorb more acid than will result following rapid dipping and immediate and thorough drainage. Put the seed to be treated in a small bag and place this in a pail containing the acid. The seed should be stirred so that all will be coated on the outside but not absorb an excess of acid. Another method of application is that of placing a small quantity of seed in a shallow pan, pouring the acid over same and stirring. Following either method the seed should be so handled as will permit thorough draining. Growers who have successfully treated the seed of kafir in this manner, do the work in the field, treating only sufficient seed to fill the planter-box once; when this has been planted, another lot is treated.

The kafir ant works on corn also. The corn kernel is soft about the germ and this portion absorbs the acid so rapidly that there is great danger in applying it. The ant also works on the planted seed of other sorghums.

George A. Dean, entomologist of the Manhattan, Kansas, Agricultural Experiment Station, to whom I referred the matter of crude carbolic acid as a protector of milo, feterita and cane against ants, recommends that because of the soft seed the dipping be done quickly, the seed thoroughly drained and the treatment given the seed in small quantities and immediately in advance of planting.

FEEDING GRAIN SORGHUMS

While the grower of grain sorghums will be able to sell the grain of these crops at a price per bushel equal to the value of their feeding equivalent in corn, the greater profit will come through the feeding of both grain and forage. If the grain of the sorghums is marketed it must be sold at a price that will allow the buyer to feed it at a profit after it has passed through several hands and each has had his share. The selling of grain and stock from western farms is a practice which has lost its followers much of the prosperity to which they are entitled. It would seem that the sorghum belt farmer who grows both feed and live stock could bring the two together at a profit to himself. The possibilities for development of the sorghum belt through grain sorghums and live stock, and the reason this combination is regarded as necessary for that development, are discussed in another chapter.

Except in the case of experienced feeders, the grain sorghums have not in the past been regarded as the best feed—at any rate the average farm feeder has not been able to get the best results from feeding them. The professional feeder has better understood feeding methods than has the farm feeder, the latter having employed feeding methods which have not combined, in proper proportions, the feeding constituents necessary to grow and finish the animal profitably. It may be safely said that the average sorghum belt farmer has been able to make animals grow or fatten and cows give milk, only during the pasture season, and so has kept animals six or seven months of the year without profit on the feed consumed and the care given. In the past, the average winter feeding in the sorghum belt has been a matter of merely maintaining the animal—keeping body and soul together —instead of actually converting feed into animal growth,

flesh and milk, and through which latter operation only can a profit be realized on feed and labor. The object of this chapter is to briefly point to a better understanding of those methods necessary to the more profitable feeding of the animals of the sorghum belt farm.

Elements of Feed and Function of Each. All feeds are composed of the same elements but in varying proportions. Every useful grain and forage plant has the constituents essential in the development of the animal body, but rarely in the proper proportions. The necessity for a proper combination of the constituents of feed can be better understood when the function of each constituent is known.

Dry matter is that portion of roughages and grains which remains after all moisture has been driven off by heat.

Protein is that element which enters into the composition of the muscles, tendons, hide, hair, horns, blood, all internal organs, and the casein or cheesy part of milk. Protein is absolutely indispensable in the formation of these. No other element of feed can take its place.

Carbohydrates supply heat and energy and produce fat. These constituents abound in the grain and forage of sorghums and corn.

Fat is closely related to carbohydrates in that it produces heat, energy and fat.

Ash is also an important constituent but this is found in all farm rations in sufficient quantity to supply the animal's requirements for mineral matter. However, it is the high lime content of alfalfa and other leguminous hays, as well as the high protein content, that makes them superior in promoting growth.

Regarding Rations. The term "ration" is used in connection with the feeding of live stock as meaning the amount of feed given the animal during a 24-hour period.

A "balanced ration" is a combination of feeds supplying protein, carbohydrates and fat in such proportions

as are required to meet the needs of the animal for a 24-hour period.

A "maintenance ration" signifies the amount of feed required to supply the nutrients necessary to maintain an animal without loss or gain in weight.

Digestible Nutrients in Grains and Roughages. It should be understood that the constituents of feeds are not wholly digestible, so the feeding value of grains and roughages is dependent upon that part of their constituents which is digestible and which can be taken into the animal system. The table below shows the pounds of dry matter and digestible nutrients in 100 pounds of the feeds named. A study of the table will reveal the relative value of the several feeds from the standpoint of composition and will assist the reader in determining upon the combination of grains and roughages needed to make a balanced ration for all classes of live stock.

Name of Feed	Dry Matter	Protein	Carbo-hydrates	Fat
Green Forages:				
Pasture grass	20.	2.5	10.2	0.5
Corn	20.7	1.0	11.6	0.4
Cane	20.6	0.6	12.2	0.4
Corn silage, well eared	26.4	1.3	14.0	0.7
Corn silage, without ears	26.3	1.1	14.9	0.7
Cane silage	23.9	0.6	14.9	0.2
Dry Roughages:				
Corn fodder, husked	57.8	2.0	33.2	0.6
Cane hay	59.7	2.4	40.6	1.2
Alfalfa	91.6	11.0	39.6	1.2
Red clover	84.7	6.8	35.8	1.7
Sweet clover	90.8	10.0	37.0	1.5
Barley hay	85.2	6.2	46.6	1.5
Oat hay	91.1	4.3	46.4	1.5
Prairie hay	87.5	3.5	41.8	1.4
Cowpea hay	89.3	10.8	38.6	1.1
Millet	92.3	4.5	51.7	1.3
Soy beans	88.2	10.6	40.9	1.2

Name of Feed	Dry Matter	Protein	Carbo-hydrates	Fat
Spanish peanut vines*....		10.	42.	3.6
Spanish peanuts, whole plant*................		18.4	40.1	21.5
Cottonseed hulls	88.9	.3	33.1	1.7
Grains and By-Products:				
Corn meal	89.1	7.9	66.7	4.3
Corn and cob meal.......	89.	6.4	63.	3.5
Kafir meal	84.8	7.8	57.1	2.7
Kafir head meal	86.4	4.2	42.4	1.2
Cane seed meal	87.2	4.5	61.1	2.8
Milo meal	91.	4.9	44.8	1.3
Milo head meal	90.3	4.2	45.	1.1
Broomcorn seed meal.....	87.2	4.6	42.2	1.5
Oats....................	89.	9.2	47.3	4.2
Barley..................	89.1	8.9	64.8	1.6
Rye.....................	88.4	9.9	67.6	1.1
Wheat...................	89.5	10.2	69.2	1.7
Cowpeas................	85.2	18.3	54.2	1.1
Soy beans		29.1	23.3	14.6
Spanish peanut kernels*..		26.6	16.7	42.0
Wheat bran	88.1	12.6	38.6	3.0
Cottonseed meal	91.8	37.2	16.9	8.4
Linseed meal	89.9	28.2	40.1	2.8

*—Composition and not digestible nutrients.

Required Nutrients for Various Animals. The comparative amounts of dry matter and digestible nutrients required per day per 1,000 pounds of live weight, by several classes of farm animals, is shown in the table below and which presents the standards determined by Dr. C. Lehmann of the Berlin Agricultural High School, and while such requirements are not now regarded as accurate, they will prove a satisfactory guide for all practical purposes. By using these amounts and by referring to the table showing the digestible nutrients of the several roughages and grains, the reader can determine upon

a combination which will supply digestible nutrients in the amounts and proportions required.

Animal—Average Live Weight	Dry Matter	Protein	Carbo-hydrates	Fat
Growing, beef cattle, 500 pounds	25	2.5	13.2	0.7
Growing, dairy cattle, 500 pounds	27	2.0	12.5	0.5
Growing swine, 120 pounds	32	3.7	21.3	0.4
Growing, fattening swine, 100 pounds	35	5.0	23.0	0.8
Growing, breeding swine, 120 pounds	32	3.7	21.3	0.4
Milk cows, 22 pounds milk daily	29	2.5	13.0	0.5
Horses, medium, work	26	2.5	13.3	0.8

The foregoing is designed only to give the reader an understanding of the necessity of combining the nutrients of feed in such proportions as are required to meet the animal's need and to place in his possession figures which will enable him to make up the most efficient ration from the available feeds. True, I have known hundreds of successful farmers who did not know the composition of the various feeds in the terms here given nor the requirements of the animal body in pounds of nutrients, but they did know the feeds necessary to produce the results they desired. They knew intuitively how to feed successfully. Infallible rules for successful feeding are as impossible as for planting or cultural practices.

Sorghum Grain Values. In general farm feeding operations the value of the grain of sorghums may be regarded as the equal of corn. It is well established that in the feeding of all classes of live stock the value of the grain of kafir is equal to 90 per cent that of corn—or 10 pounds of kafir is equal to 9 pounds of corn. Feeding trials and farm feeding experience place near the same value on milo. No feeding tests of feterita are re-

corded, but those farmers who have fed it give it equal rank with kafir and milo. The composition of feterita compared with kafir and milo would indicate the correctness of this conclusion. Milo and feterita have a beneficial laxative effect which kafir does not possess. However, animals will get "off feed" on milo and feterita more easily than on the grain of kafir.

The composition of cane seed compared with grain sorghums indicates about equal feeding value but it is less palatable and this is probably the most serious objection to it. Cane seed has a high value as poultry food.

While a detailed discussion of the relative feeding value of the grain of sorghums compared with corn or other feeds would prove interesting and of value, the space required can better be devoted to other phases of the subject. The fact is that the grower of grain sorghums can not afford to quibble over so small a matter as that of relative values. The man who can grow sorghums better than corn or who cannot grow corn at all, can well afford to overlook small differences in feeding value.

Sorghum Forage Values. The forage of the grain sorghums, ton for ton, is equal to the forage of corn. In acre ton yield the sorghums usually exceed corn when grown under the same conditions. The heaviest acre yields of forage can generally be had from sorghums when grown as exclusive forage crops. Cane will usually exceed all other sorghums in forage yield. However, kafir is a close competitor and in view of the desirability of the grain, will generally prove a more satisfactory forage crop than cane. The forage of milo and feterita is not equal to that of cane or kafir, nevertheless, it is successfully used, both cured and as silage. These are not so heavily leafed as kafir or many varieties of cane, accounting for their lower value. As is true of corn, the leaf of the sorghums is the valuable part of the forage.

Keeping Quality of Forages. The forage of the sorghums keeps well—as well as alfalfa, millet or prairie hay—and if properly stacked can be fed with good results

when several years old. Cane is the only exception and its keeping quality depends largely upon the variety, the season and the time of cutting. Excessively juicy cane does not keep well. The juices become sour and this condition depreciates the palatability. It is my experience that bright, well cured cane forage is more palatable than that of other sorghums, but it is more relished in the early part of the feeding season than later. On farms on which cane and kafir are both grown for forage, the cane should be fed first. It is the common practice in many localities to mix cane and kafir about half and half, when planting, growers believing this makes the best cured forage.

Protein Grains and Hays. The grain sorghums are rich in carbohydrates—the constituents which produce fat and heat in the body. When fed alone they do not supply the protein necessary to enable the animal to make rapid or large growth or economical and profitable gains. In this respect the grain sorghums are not different from corn. The feeding problem for the sorghum belt farmer in producing a properly balanced ration for his live stock is no different, therefore, than the problem which confronts the corn-growing farmer, except that in the corn belt grains and hays rich in protein, and which afford the necessary balance for the ration, are more easily produced. The following grains and hays are more or less adapted to the several sections of the sorghum belt and can be successfully used in balancing the grains and roughages of the sorghums.

Alfalfa. Alfalfa hay, when home-grown and fed with the grain or silage of kafir, milo or corn produces a satisfactory feeding combination which for cheapness probably cannot be excelled. Its protein content is high, being in excess of 10 per cent, and a ton of its leaves in feeding value comes near equalling a ton of bran. Its hay is about one-third as rich in protein as cottonseed meal. Alfalfa gives the best yields on fertile, well drained lands under abundant rainfall, but the crop is not to be regarded as

unprofitable because on other lands the yields are reduced to one-fourth or even less compared with those of the best lands. An acre of upland yielding one-half ton of cured alfalfa hay per season, yields 110 pounds of protein, 396 pounds carbohydrates, and 12 pounds of fat, or a total of 518 pounds of digestible nutrients. In one-half ton of cane or kafir hay there are 24 pounds protein, 400 pounds carbohydrates, and 12 pounds fat, or a total of 436 pounds of digestible nutrients. It requires two and one-fourth tons of cane to produce as much protein as is contained in one-half ton of alfalfa hay. The farmer who grows only one-half ton of cured alfalfa hay per acre, should measure its value, not alone by its total digestible nutrients, but also by the value its nutrients give to those of other roughages when fed in combination. The same view must be taken of the yields of all protein hays and grains when comparing them with others rich in carbohydrates.

On the level uplands east of the 98th meridian in Kansas and Oklahoma, alfalfa generally does sufficiently well to make it a profitable crop as compared with other crops produced by the same kind of land. Farther west there are lowlands—other than the creek bottoms—on which it will prove profitable to grow alfalfa. On such land one fair crop a season is assured and in favorable seasons two or three cuttings may be made.

On the uplands west of the 98th meridian the profitable production of alfalfa is not assured. However, on such lands there is an occasional grower who reports satisfactory alfalfa yields by sowing in rows two feet apart and giving clean, shallow cultivation. Numerous attempts have been made in row-seeding but failure has generally resulted. The failures almost universally follow neglect, the fields not having been cultivated and kept clean and the alfalfa left to win or lose in competition with the grass and weeds. The successful row-seeded fields are always those which have been kept clean and the soil moisture stored and conserved. Under this method

growers claim a good first cutting and a crop of seed, the hay crop running one and one-half to two tons per acre and seed crop three to five bushels. Alfalfa is dry weather-resistant, it uses the soil's moisture economically and is in reality a good dry land crop when given proper care.

Sweet Clover. The reader will note by reference to the table that the digestible nutrients contained in sweet clover are near equal to those of alfalfa. When cut early for hay, it has a feeding value almost equal to alfalfa. The stems are somewhat coarser and more woody than alfalfa, resulting in a greater wastage in feeding and it is principally on this account that its feeding value is depreciated as compared with alfalfa. It stores nitrogen in the soil as does alfalfa and as a subsoiler is one of the best plants for breaking up hard, stiff soils. It is biennial and lasts but two years unless it is allowed to re-seed.

Investigation in the spring of 1913 into sweet clover growing in the western third of Kansas, revealed that in every county there were farmers who had adopted it as a crop. It is producing satisfactorily on upland at Akron, Colorado, a point having an altitude of 4,560 feet and an annual precipitation of about 15 inches.

There seems ample evidence that sweet clover will prove a satisfactory hay and pasture plant outside of the area of successful alfalfa growing and it is certainly worthy of a thorough trial.

Soy Beans. The soy bean will produce a crop on land too poor for corn. It is fully as dry weather-resistant as kafir, matures in 80 to 100 days and is not molested by chinch bugs. Fifteen years ago soy beans were given a trial here and there throughout Western Kansas. These trials were not generally satisfactory, principally because the jack rabbits ate the small plats planted. In the few fields of such size that rabbits could not totally destroy them, the results were satisfactory. There was no more good reason for discontinuing these trials than for

discontinuing kafir or milo because of the fact that chinch bugs damage it more or less year after year.

Cowpeas. Cowpeas are adapted to a considerable proportion of the sorghum belt and will materially aid the sorghum-growing farmer in providing protein for balancing rations composed mainly of sorghum roughage and sorghum grain. They grow on almost any soil, although, like all other crops, they produce maximum yields on fertile soil and under abundant rainfall. There are dwarf and early-maturing varieties, however, which produce both grain and hay in profitable quantities in the areas of lighter rainfall. East of the 98th meridian in most years they may be planted as a catch crop after early harvest. West of this meridian they should be planted in the spring as soon as the ground is warm. When planted in a well prepared, clean field their ability to withstand dry weather and produce a crop, is remarkable. In the drier sections they should be planted in rows and cultivated as is corn. As shown by the table giving the composition of various feeds, in protein content, the hay of cowpeas is equal to alfalfa and the seed about one-half as rich in protein as cottonseed meal. The hay of cowpeas is successfully siloed with other roughages and greatly improves the silage of corn and the sorghums. The cowpea is also a nitrogen-gatherer and stores this element in the soil.

Spanish Peanuts. The Spanish peanut has recently been proven a valuable crop for sections of light rainfall. The high protein content of the vines, the whole plant, and of the kernels, makes it desirable and adapted in balancing common roughages and grains.

The peanut possesses dry weather-resistance. It is planted in rows as is corn, and is cultivated. In the drier sections it is planted shallow with a lister, preferably on ground which has been fall plowed and disked in the early spring. Planting should be done a little later than in the case of corn.

While the hay and the seed are valuable in feeding all

kinds of live stock, the crop is easily harvested and profitably consumed by turning hogs into the field. It is estimated that an acre grown under the conditions of Southwest Oklahoma will put 500 to 1,000 pounds of gain on hogs when the crop is gathered by them.

Protein for the Milk Cow. Many times the reader has heard it said that the grain and roughage of sorghums "dry" milk cows. The fact is that the cow cannot eat sufficient of the roughage or grain of these to supply the protein required to produce milk. The 1,000-pound cow producing 22 to 25 pounds of milk per day, requires about 2.5 pounds of protein, 13 pounds of carbohydrates, and one-half pound of fat. The following ration, common to sorghum belt farms, illustrates the deficiency of protein in such ration and why it is not satisfactory in milk production.

	Protein	Carbohydrates	Fat
Cane hay, 20 pounds	.40	8.12	.24
Kafir meal, 10 pounds	.78	5.71	.27
Total nutrients	1.26	13.83	.51
The cow requires	2.5	13.	.5

The ration below shows how a protein hay with the grain of kafir, supplies the required protein, and although slightly deficient in fat, heat and energy-forming constituents this deficiency can be supplied by increasing the amount of kafir meal.

	Protein	Carbohydrates	Fat
Alfalfa hay, 18 pounds	1.98	7.12	.22
Kafir meal, 8 pounds	.62	4.56	.22
Total	2.60	11.68	.44
The cow requires	2.5	13.	.5

The following ration illustrates how other sorghum belt feeds may be combined. This ration contains a surplus of fat-forming nutrients but unless the cow is

strongly inclined to take on fat the excess will not prove objectionable.

	Protein	Carbo-hydrates	Fat
Cane hay, 20 pounds	.48	8.12	.24
Kafir meal, 8 pounds	.62	4.56	.22
Soy bean meal, 5 pounds	1.45	1.16	.73
Total	2.55	13.84	1.19
The cow requires	2.5	13.	.5

With silage as the principal roughage, the following rations offer a suggestion. The deficiency in carbohydrates can easily be supplied by increasing the kafir meal. Cottonseed meal is used in the ration because if protein must be bought this meal will supply it at the lowest cost.

	Protein	Carbo-hydrates	Fat
Kafir silage, 30 pounds	.18	4.47	.06
Kafir head meal, 5 pounds	.21	2.12	.06
Cottonseed meal, 3 pounds	1.11	.5	.25
Sweet clover hay, 10 pounds	1.00	3.70	.15
Total	2.50	10.79	.52
The cow requires	2.5	13.	.5

	Protein	Carbo-hydrates	Fat
Kafir silage, 20 pounds	.12	2.98	.04
Sweet clover hay, 20 pounds	2.00	7.40	.3
Kafir meal, 3 pounds	.23	1.71	.08
Total	2.35	12.09	1.5
The cow requires	2.5	13.	.5

By referring to the table showing the digestible nutrients contained in the several feeds the reader will note the roughages and grains of similar composition which can be substituted in the above suggested rations.

Of all farm live stock, the milk cow—according to her

needs—is the poorest fed. This somewhat detailed reference to her ration is given because in the area of kafir, milo and cane the small farmer needs to place a greater dependence upon the profitable feeding and milking of a few cows.

Those protein feeds more or less adapted to each section of the sorghum belt and to which the farmer must look for his protein—if he grows it—are briefly mentioned above. It is not within the scope of this book to report detailed methods of planting, cultivation, harvesting, etc. That is another story.

Palatability and Succulence Necessary. In a combination of feeds palatability must not be overlooked. Animals will not thrive on any ration unless it is relished. Harvesting at the right stage, proper curing, and protecting from damage by the elements, will preserve palatability. A variety of feeds adds to the palatability of a ration.

A good ration possesses succulence—that quality which makes the green forage of any crop more palatable and efficient than the cured forage. Succulent feeds are always relished. This is the condition which makes the silage of sorghums so much more palatable and which gives generally better results in feeding than the dry forage. Silage or succulent feeds keep the bowels in normal condition, the skin soft and the coat glossy, which are important because they are indicative of such condition as enables the animal to make the best use of the feed consumed. This condition can best be maintained through the use of succulent feeds such as silage or beets or pumpkins.

Those laxative feeds common to the sorghum belt and which tend to maintain a normal condition of the bowels, are: Alfalfa and cane hay, the grain of milo and feterita, soy beans, cowpeas, Spanish peanuts and linseed meal. The constipating feeds are the forage of corn, kafir, milo, feterita, prairie hay, the grain of kafir and cane, corn in small quantities, and cottonseed meal.

Various rations could be made from constipating feeds which would contain all the constituents needed for growth, flesh or milk, but such would give poor results.

Exchange of Feeding Stuffs. I have held that the sorghum belt farmer should grow the feed needed for his live stock. There is little occasion for the farmer contributing to the miller for feed stuffs. However, if he cannot grow the protein feeds needed he can often make money by selling grain and buying protein concentrates. For example, if the farmer has only the forage and grain of kafir for feeding milking cows, he cannot supply the herd with the protein needed to enable the cows to produce milk to their capacity. In 56 pounds of threshed kafir reduced to meal there are 4.36 pounds of digestible protein and at 60 cents a bushel such protein costs in the ration, 14 cents per pound. In cottonseed meal at $30 per ton, a pound of digestible protein costs slightly in excess of four cents. In other words, a bushel of kafir which can supply only 4.36 pounds of protein, will buy 15 pounds of digestible protein in cottonseed meal. This will give the reader the principle involved in the exchange of feeds and enable him to determine when he can afford to exchange grains grown on the farm for other feed stuffs. Many other examples might be mentioned, but reference to the table of digestible nutrients and consideration of market prices will enable the reader to readily determine the profitableness of any contemplated exchange.

Kafir in Combinations for Swine. Swine feeding tests at the Manhattan, Kansas, Agricultural Experiment Station, have established the value of kafir compared with corn in feeding hogs. The same station has shown the advantages of combining protein feeds with corn and kafir. Those trials which will be of particular interest to sorghum belt farmers are summarized in the table below:

Ration—	Avg. Wt. Lbs.	Days Fed	Daily Gain Each	Grain 100 Lbs. Gain
Kafir meal	156	77	1.37	515
Corn meal	156	77	1.70	438
Ground wheat	156	77	1.78	411
Kafir meal ⅔, soy bean meal ⅓	63	126	1.44	396
Corn meal ⅔, soy bean meal ⅓	63	126	1.46	369
Kafir, whole, threshed	188	49	1.39	542
Kafir, whole, soaked	188	49	1.35	632
Corn, shelled, dry	188	49	1.50	457
Kafir meal, wet	188	49	1.85	471
Kafir meal ⅘, soy bean meal ⅕, wet	188	49	2.12	409
Kafir meal ½, corn meal ½, wet	188	49	1.91	456
Kafir meal, soaked	35	112	.66	542
Kafir meal ⅔, soy bean meal ⅓, soaked	35	112	1.15	374

The profitable use of alfalfa hay, alfalfa pasture and skim milk in supplying protein in the hogs' ration, is shown by the table below. The results in feeding alfalfa hay as an effective means of balancing the ration, are particularly striking. The small amount of grain required to produce 100 pounds of gain when skim milk formed a part of the ration, is also noteworthy.

Ration—	Avg. Wt. Lbs.	Daily Gain Each	Grain 100 Lbs. Gain	Hay 100 Lbs. Gain
Kafir, whole, dry, alfalfa	126	1.41	515	72.4
Kafir meal, alfalfa meal	126	1.32	538	78.8

Ration	Avg. Wt. Lbs.	Daily Gain Each	Grain 100 Lbs. Gain	Hay 100 Lbs. Gain
Kafir meal ⅘, soy bean meal ⅕......	126	1.55	468	
Kafir meal, wet, alfalfa............	165	.88	538	214.
Kafir meal, cottonseed meal, wet........	165	.95	466	73.8†
Kafir meal, skim milk............	165	2.43	268	526. *
Kafir, skim milk, alfalfa pasture......	124	1.68	477	298. *
Kafir, skim milk.....	124	1.57	500	318.
Kafir, alfalfa pasture	124	1.08	554	
Kafir, whole........	124	.99	638	

† Pounds of cottonseed meal per 100 pounds gain.
* Pounds of skim milk per 100 pounds gain.

Grain Sorghums For Sheep. The experiment stations of the grain sorghum belt have thoroughly established the value of kafir and milo as compared with corn in the production of mutton. Sheep feeders in Kansas, report good results in feeding the grain of sorghums with alfalfa hay and the feeders of Texas have had satisfactory gains from feeding the grain in the head with millet and cane hay as roughage. It is quite generally regarded that the sheep is better able to grind its own grain than are other farm animals and the use of whole grain is recommended. Professor Henry, of Wisconsin, says it is true that "a sheep which cannot grind its own grain is not worth feeding."

Kafir For Horses. For horses, kafir heads may be substituted for ear corn. Horses relish kafir in the heads more than in any other form. It is economy to chop the heads into two or three pieces with a hatchet or corn knife. Threshed kafir should be ground for horse feed. Ground heads are not relished by horses. The Manhat-

tan, Kansas, Agricultural Experiment Station horses, doing heavy farm work, have been fed the same weight of kafir heads as of ear corn with entirely satisfactory results. This experience is verified by thousands of farmers throughout the kafir and milo-growing sections. Young horses and those not working will maintain themselves in good condition on the roughage of sorghums which has a small quantity of grain.

Kafir and Skim Milk For Calves. For the skim milk-reared calf, kafir meal has proven a good substitute for the fat removed from the milk. Calves should be fed whole milk until they reach the age of ten days or two weeks, at which time they begin to eat meal and roughage. At first, put a little kafir meal in the calf's mouth after it has finished drinking. Soon the calf will eat the meal with a relish and skim milk may be gradually substituted for the whole milk. Four-weeks-old calves will require three-fourths to a pound per day, and eight-weeks-old calves one and a half to two pounds. Do not mix kafir meal or the meal of other grains with the milk, but permit the calf to eat the grain. Kafir meal is particularly adapted to feeding with skim milk because of its constipating effect materially assisting in checking the tendency to scour. The meal of milo and feterita, being laxative, is not so desirable for feeding with skim milk. Whole grain may be substituted for the meal so soon as the calf can eat it. When the calf eats readily, heads chopped into two or three pieces can be fed. In feeding the whole grain there will be some waste but this will be less with calves than with older animals.

Head Meal of the Sorghums. There is no experimental data which has definitely determined the value of the head meal of kafir, milo and other sorghums compared with the meal of the threshed grain. However, many feeders have for years been grinding heads and the feeding results are such as warrant generally careful inquiry into the value of head meal and the practicability of using it.

All experience indicates that generally the grain of kafir should be ground for feeding, but the storing of the threshed grain and of the meal from the same is attended by more or less difficulty because of heating in the bin. If the feeding of head meal is practical, as feeders believe, then these difficulties are overcome because the heads can be safely stored for an indefinite period, and the head meal if kept dry, is in little danger of heating. On a farm equipped with a grinder the heads can be ground as needed. The expense of grinding need be but slightly in excess of grinding the threshed grain and the threshing expense is saved.

Here is what J. G. Mitchell, Wilson County, Kansas, wrote Kansas Farmer, January 1912: "Kafir should never be threshed, but fed either in the head or the heads ground. In either of these forms it will keep indefinitely. The meal of threshed kafir is too heavy for good feeding. When ground in the head I have found it to be fully the equal of corn chop and bran mixed, and much cheaper. If it is desired to hold the surplus for another feeding season it will keep perfectly in the head."

Mills for Grinding Heads. There are several mills adapted to farm use which successfully grind the heads of kafir, milo and other sorghums, as well as corn in the ear and all small grains. Such mills sell at prices ranging from $75 to $125 f. o. b. shipping point. These are belt-driven, not sweep mills, and have a claimed capacity of 1,200 to 1,800 pounds of kafir or milo head meal per hour, depending upon the condition of the heads, fineness of feed desired, and speed at which mill is operated.

Provide Variety of Feeds. The most trying time in the feeding of live stock is in the late spring when all forage-eating animals are instinctively inclined to grass and by which time have tired of the winter's roughage. It is at this time when choice forage is most appreciated by the good live stock feeder. An extra effort should be made to have palatable feed at this season and if a part

of the forage should be a little finer and brighter and more appetizing than another, it should be saved for spring feeding. On every sorghum-growing farm can be grown forages which will afford variety during the fall and winter and which will supply appetizing roughages for the period just preceding grass. If the farm does not grow alfalfa or sweet clover hay, then early cut prairie hay, oat, wheat, rye or barley hay, cowpeas, etc., may be had. These make most excellent roughages for use in the stable for evening feeding or when the stock is kept up on a stormy day. It should be kept in mind that a variety of forages and grains will give the best feeding results.

Sorghums for Pasture and Soiling. The value and need of supplemental pasture or crops which can be fed green during times of short grass pasture, is realized by every grower of live stock but in actual practice commands little attention. The sorghums are admirably adapted as pasture or soiling crops. They are rapid growers, remain green and succulent longer than other crops and yield a liberal acre tonnage. Cane and kafir are better adapted to these uses than other sorghums because of their greater succulence and larger proportion of leaves.

While it is generally considered safe to pasture horses, mules and sheep on sorghums under all conditions of growth, nevertheless, an ounce of caution is worth a pound of cure. The pasturing of cattle should be attended by caution at all times, because of the danger of prussic acid poisoning. I have pastured sorghums under all conditions which present themselves to the average farmer, without serious results, and I know farmers who make a practice of pasturing sorghums and who have experienced no loss of consequence in proportion to the value of the pasture. The experience of the reader, however, may have proven or may prove disastrous, and he should therefore use such pasture carefully.

Sorghum pastures are well worth providing for hogs

alone. Swine are not susceptible to sorghum poisoning. The plants may be pastured when 12 to 18 inches high, but the stalks never get so large that the hog cannot derive all the benefits of the pasture. On many farms three or four lots are sowed ten days to two weeks apart, and thus when one lot becomes eaten out, another pasture is available. Sorghum pasture produces small gains on hogs but its conditioning effect is such as induces the use of other feeds at their maximum value.

The sorghums are excellent crops for cutting and feeding green. While the best results and the largest tonnage will be obtained when the plant is near maturity, it can be used during any stage of its growth. The labor involved in soiling is the principal objection to this method of feeding. However, whether soiling is laborious or not, depends much upon the ingenuity of the farmer. The corn binder is handy in cutting soiling crops because the bundles are easily handled. For a small herd, a day's feed in bundles can be placed on a hay-rack and fed in racks or on the ground twice daily. The soiling crop should be grown near the feed lot or pasture. Should prussic acid be present in the green forage, feeding in this manner is as dangerous as pasturing.

The day is not far distant when the supplemental summer feed will be the silage of these crops. Feeding from the silo will result in a minimum of labor and maximum of convenience.

Prussic Acid Poisoning. The serious objection to sorghums as pasture or soiling crops, is the danger of prussic acid poisoning. Prussic acid in quantities sufficient to prove fatal to cattle, is common to all sorghums and to two hundred species of other plants. Writing on the subject in Kansas Farmer, G. C. Wheeler, associate editor, says:

"There is something mysterious about the development of prussic acid in the sorghums. Experiment station veterinarians know little about the causes tending to produce this poisonous condition. It was believed for some

time that it developed only in second growth sorghums. It was also believed that frosted cane or kafir was likely to be poisonous. Both of these theories, however, have been disproven.

"Dr. A. T. Peters, formerly of the Nebraska Agricultural Experiment Station, who has probably given the development of this poison in sorghums more attention than any other veterinarian, ventures only one conclusion, namely, that the poison seemed to be more prevalent during seasons in which a stunted condition of the plant was produced. It appeared that at times the plant was poisonous for only a very short period, being apparently safe when that period had expired."

It is certain that the loss of cattle through sorghum poisoning is greater during seasons when the normal growth of the plant is checked by dry, hot weather. Such conditions as existed throughout the sorghum belt in 1913, seem favorable to the development of prussic acid and in that year reports of cattle losses were numerous. Positive information cannot be given as to what results follow the siloing of green sorghums which contain this poison. However, it is believed that the fermentations which take place in silage will destroy or counteract the effect of this poison. It is reasonably safe to so conclude that such is the case since there are no recorded instances of poisoning from the feeding of sorghum silage, and it is certain that millions of tons of sorghums which in all probability contained prussic acid were siloed in Kansas in 1911 and 1913. It is also believed that this poison does not exist in dangerous quantities in cured forage, there being only one instance in the history of the Kansas station in which prussic acid was found in the cured forage in sufficient quantity to kill cattle.

In cases of prussic acid poisoning a strong solution of corn syrup or molasses may be administered as an antidote. Large quantities of milk may also be given with good effect. A solution of 100 parts of sulphate of iron mixed with 250 parts of water, and 15 parts of calcined

magnesia mixed with 200 parts of water, is also effective. These two solutions are mixed and given to horses or cattle in doses of ten to forty ounces. The antidotes should be administered at once and in all cases the affected animal should be kept in the open air.

Kafir and Cane Silage. The value of kafir and cane as feed crops has been more than doubled within the past few years as a result of the success with which the silage of these has been fed. With the establishing of the feeding value of these as equal or superior to corn, every acre of cane or kafir-growing land may properly be considered as having a value equal to land which will produce an equivalent tonnage of corn. In other words, an acre of land in the sorghum belt which will grow 10 tons of cane or kafir silage is equal in value to land which will grow 10 tons of corn silage with equal certainty or regularity. The equality of kafir or cane silage in comparison with corn is an important discovery for the sorghum belt farmer because it points to him the added possibilities for increased prosperity through a more certain feed supply and the most economical feeding of his live stock and particularly in the more profitable production of beef and milk.

In the early "nineties" the Alabama Agricultural Experiment Station reported the silage of saccharine and non-saccharine sorghums as ranking close to corn, and the Texas Station reported results leading to the conclusion that the silage of kafir compared favorably with that of corn. As early as 1903 the Manhattan, Kansas, Agricultural Experiment Station recommended the use of kafir for silage in preference to corn in all those sections where kafir yielded a greater quantity of forage and grain than did corn. Following this recommendation farmers here and there throughout Kansas siloed both kafir and cane when they failed to grow corn, and in feeding were achieving only moderate success. It is now certain that the early silage of these sorghums was cut when the plant was immature, producing silage com-

paratively low in feeding nutrients and also too sour to be palatable.

It was during the feeding season of 1912-13 that the Manhattan, Kansas, station sought to learn the fact regarding the merits of kafir and cane silage as compared with corn for milk and beef production, and the results of this investigation are worth to Kansas farmers much more than the Agricultural College had to that date cost the state. It is not over-estimating the value of these silage trials to say that their worth to Kansas alone cannot be measured in dollars. The tests apply with equal importance to Oklahoma, Texas, New Mexico, Colorado—those states or parts of which comprise the entire sorghum belt—as well as to other states which are growing or can grow a larger tonnage of cane and kafir than of corn. In Kansas and Oklahoma during the feeding seasons of 1912-13 and 1913-14, the use of cane and kafir silage has been so thoroughly tried by farm feeders as well as by professional feeders, that the accuracy and value of the experimental data has been proven and established and it may now be considered that there is no longer any question regarding the value of the silage of these sorghums. The principal source of satisfaction, however, comes through the fact that these crops produce roughage with which to fill the silo in seasons when corn fails. So the measure of the farmer's value is not alone through the equality of kafir and cane silage as compared with corn, but from the standpoint of a more certain feed supply.

The value of milo and feterita as silage has not been determined by agricultural experiment stations, but reports from feeders indicate that each produces silage which gives satisfactory feeding results. The point, however, is this, that for those farms which can grow better yields of milo or feterita or on which they are more certain than kafir or cane, they are satisfactory silage crops.

The siloing of the fodder of corn, kafir or cane has also

proven successful and this also gives added value to these crops. The cutting of the dry forage with the addition of one-third to one-half its weight of water at time of siloing, makes it more palatable than in the dried form and almost totally eliminates the waste.

Kafir and Cane Silage For Milk Cows. The first of the recent trials by the Manhattan, Kansas, Agricultural Experiment Station to test the comparative values of kafir, cane and corn silage for feeding milk cows, was conducted in 1911-12 and gave the same results as the tests the year following.

The following deductions are from the published conclusions of O. E. Reed, Professor of Dairying, and his assistant, J. B. Fitch, who planned and conducted the tests:

Corn silage is slightly superior as a milk producer, to silage made from kafir and cane.

Kafir silage ranks second and cane silage third as a feed for milk cows.

In both trials the cows seemed to gain in live weight on cane silage more readily than on the silage made from kafir or corn. This would indicate that cane silage contains more fattening nutrients than kafir or corn. It is believed that the cane silage would prove the equal, ton for ton, of the corn or kafir silage if the grain ration were changed so that the animal could use the nutrients more economically. This could be done by feeding more protein and less fat-forming nutrients in the grain ration.

Although the kafir and cane silage were shown to be slightly less valuable than corn silage, there are other factors that must be considered, namely, yield and adaptability to local conditions. Without doubt, the increased yield of cane and kafir per acre will offset the slight increase in feeding value obtained from corn silage. Kafir and cane are dry weather-resistant crops and can be grown over a wider territory than corn, and from one-third to one-half more tonnage per acre can be obtained.

Most of the cane seed and a large amount of the kafir grain passed through the animals undigested. This sug-

gests that the nutritive value of these crops as silage is, to a great extent, limited to the nutritive value of the stalks and leaves.

The quality of silage was very good. The kafir was perhaps the poorest on account of being immature when the heavy frost forced an early harvest.

The cows ate the silage with relish. The cane silage seemed to be the most palatable.

The time of cutting cane and kafir for silage is all-important in making good silage. These crops should be practically mature; that is, the seed should be mature. At this time the stalk still possesses enough juices to make good silage. If put up too green it will make sour silage. The silage should be put up before frost if possible, but it is advisable to let the crop stand until after frost instead of putting it up too green. After a heavy frost the crop should be cut and siloed immediately. If the forage dries out too much before cutting, add sufficient water to pack well.

Wintering Beef Calves on Silage. Every grower of beef cattle is vitally interested in the economical wintering of such stock. The Manhattan, Kansas, Agricultural Experiment Station, during the winters of 1912-13 and 1913-14, made a series of trials in wintering beef cattle, the results of which trials are briefly summarized below by G. C. Wheeler, associate editor of Kansas Farmer.

In the first trial 50 calves were divided into five lots of ten each. The first, second and third lots were fed kafir, cane and corn silage, respectively, as the only roughage, and one pound of cottonseed meal was fed each calf daily. One of the remaining lots was fed corn silage and alfalfa hay, the other corn stover, alfalfa hay and enough shelled corn to equal the amount of corn in the silage fed the other lot. Each lot was fed 100 days, and the following values were placed on the several kinds of feed: Corn silage, $3 per ton; kafir and cane silage,

$2.66; alfalfa hay, $10; corn stover, $3; cottonseed meal, $30, and shelled corn, 50 cents per bushel.

The average daily gains ranged from 1.5 pounds in the corn silage lot, to 1.62 pounds in the kafir silage lot. The feed cost per day per calf, for the kafir silage lot, was slightly less than five and one-half cents, and for the lot receiving stover, shelled corn and alfalfa, almost six cents. The cost of the gains per hundred pounds was lowest in the kafir silage lot, being $3.37, and highest in the lot receiving corn silage and alfalfa hay, being $3.83. The profits per lot were $47.05 for corn silage; $51.03 for cane silage; and $60.46 for kafir silage.

The results indicated that the three kinds of silage when supplemented with cottonseed meal, were about equal. The greater economy of the silage ration is apparent since it required only about one and a half acres to produce the silage for each lot, while the lot wintered on corn stover, alfalfa hay and shelled corn required four acres—one acre to produce the alfalfa, two acres for stover alone and one acre for stover and corn combined.

In the 1913-14 test 102 heifer calves were divided into six lots of 17 each. On three lots, corn, cane and kafir silage was compared. The silage fed contained no grain but each calf was given one pound of shelled corn, one pound of linseed meal, daily, and with this a small amount of straw. During the 100-day feeding period the kafir silage lot gained 1.48 pounds per day per calf, the corn silage lot, 1.18, and the cane silage lot, 1.3 pounds. The feed cost per hundred pounds of gain was lowest in the kafir silage lot, being $5.26, highest in corn silage lot, $6.73, and in the cane silage lot was $5.98. On the basis of prevailing market prices, the kafir silage made a profit per head, of $2.48; corn silage, 49 cents; cane silage, 77 cents.

Each of the other three lots in this trial was fed cane silage, straw, and one pound of corn per calf per day, one lot being fed cottonseed meal, another cold pressed cottonseed cake, and the other alfalfa hay as a protein supplement.

The lowest average daily gain per calf was 1.12 pounds on cane silage and alfalfa hay, the highest 1.4 pounds on cane silage and cottonseed meal. The latter lot made the cheapest gains per hundred pounds, the cost being $5.52 or a profit per calf of $1.83. The cost per hundred pounds of gain from cane silage and cold pressed cake was $5.90, and the profit per calf, $1.31. The cost of gains produced by cane silage and alfalfa was $6.92 per hundred, and the profit per calf, 13 cents.

The poorer showing of corn compared with cane or kafir, was undoubtedly due to the injury done the corn by dry weather. The good showing made by the kafir and cane silage under the extremely trying conditions of 1913, is a strong point in favor of these crops for silage.

In the above trials charges were made each of the six lots as follows: Silage, $4 per ton; linseed meal, $33; cottonseed meal, $31; cold pressed cottonseed cake, $26; alfalfa hay, $14; wheat straw, $2; shelled corn, 70 cents a bushel.

Wintering Beef Breeding Cows at Hays. The study of wintering mature beef breeding cows on kafir silage was begun at the Hays, Kansas, Agricultural Experiment Station, during the winter of 1912-13. Four lots of 19 cows each were fed for 100 days. Each lot was given one pound of cottonseed meal per head, daily, and all the wheat straw the cows would eat. Two lots received kafir silage, one having practically a full ration of 35 pounds daily, the other limited to 20 pounds daily. One of the other two lots was fed kafir fodder with the grain, the other kafir stover—fodder from which the heads had been removed.

The cows in all lots wintered in fairly good condition, the gains ranging from 36 pounds per cow in the lot receiving the kafir stover, to 124 pounds in the lot receiving the full ration of kafir silage. The lowest feed cost per cow was $4.93 for the lot receiving 20 pounds of kafir silage. The cost of wintering the lot receiving the full silage ration was $7.19 per cow. The most expensive win-

tering cost was $7.21 per cow for the lot receiving the kafir fodder containing the grain.

The above cost figures are based on the following ton charges: Silage, $3; kafir fodder, $4; kafir stover, $3; wheat straw, 50 cents; cottonseed cake, $30. The kafir used in filling the silos yielded at the rate of about eight tons per acre. It was estimated that the same fields yielded four tons of air-dried fodder per acre, and three tons of kafir stover.

The large amount of straw consumed by the silage fed cows was significant. The cows on the limited silage ration consumed an average of 17.2 pounds of straw daily. Those on full silage ration, 14.2, while those eating dry kafir fodder and kafir stover consumed only a little more than 10 pounds daily.

From the standpoint of economy in the use of feed, the small acreage required to produce the kafir silage is especially worthy of note. The limited silage ration required only one-eighth of an acre to feed one cow, and the full silage ration required one-fifth of an acre. The ration for the lot fed kafir stover required almost one-half acre.

During the winter of 1913-14 at the same station a 136-day test was made in wintering breeding cows. Two lots were fed kafir fodder, wheat straw, five to six pounds of kafir silage and one pound of cottonseed cake, each, per day. The third lot was fed the same roughage ration but given one pound of linseed meal and a little alfalfa hay. The cows wintered in fairly good condition, the total gain per animal ranging from 18.6 to 55.7 pounds. The cows were fed for maintenance only, and no gains were expected.

The low feed cost resulting from the use of kafir silage as the bulk of the ration, was significant. The lowest feed cost per cow was in one of the lots receiving the cottonseed cake and amounted to $4.53. The highest cost was that of the lot receiving linseed meal, being $6.17 per cow.

For the past three years the station authorities have been closely watching the effects of cottonseed cake in the ration for breeding cows. The results of this last test indicate that the linseed meal supplement is safer than the cottonseed cake, since no cows aborted in this lot and some abortions occurred in the lots fed cottonseed cake.

Silage for Horses. On every farm having a supply of silage the horses and mules are given their share. Silage will not enter into the ration of the horse to the same extent as in the case of cattle, because the horse requires a more condensed ration. Mouldy silage cannot safely be fed to horses or mules.

A Barber County, Kansas, feeder counts silage as one of the best horse feeds. He has been feeding from 30 to 40 head of colts and mares, and a number of mules, each year. The ration is made up of silage and alfalfa hay.

Cost of Filling Silos. The cost per ton of putting up silage cannot be definitely stated because of the wide range of varying conditions under which the work is done. In February 1913, Kansas Farmer printed the statements of a considerable number of silo users and the cost of filling ranged from 55 cents per ton to $1.50. These statements indicate that the average expense of silo filling, including all labor and power—but not including interest on investment—was about 75 cents per ton.

Marketing Grain Sorghums. Growers need have no fear regarding a market for the surplus grain of the sorghums. So soon as enough grain is grown within hauling distance of any point to make shipping worth while, there will be a buyer, and the supply will be as readily absorbed as corn, oats, barley or other grains.

A large proportion of the marketable kafir and milo is used in mixed poultry feeds. This demand is increasing. Three large Chicago users buy an average of 350,000 bushels a month, and firms located in New York shipped a million bushels from Galveston in December 1912 and January 1913. Mixers of poultry feed would greatly increase their purchases if the available supply

were larger. There are millions of tons of mixed feeds sold for horses and cattle and many manufacturers of these would use grain sorghums if their requirements could be supplied.

Galveston grain men express the belief that a large, permanent market for kafir and milo can be created in Europe. In December 1912 and January 1913 that port forwarded 76,853 bushels, distributed to Antwerp and Liverpool. The above export shipments were made at 96½ cents per hundred pounds or 54 cents per bushel f. o. b. vessel, milo commanding five cents per bushel higher price than kafir.

Grades for Kafir and Milo. The standard grades for kafir and milo which have for several years been established on the Wichita, Kansas City and Chicago grain exchanges, are:

White Kafir—No. 1 shall be pure white, of choice quality, sound, dry and well cleaned; No. 2 shall be seven-eighths white, sound, dry and clean; No. 3 shall be seven-eighths white, not dry, clean or sound enough for No. 2; No. 4 shall be seven-eighths white, badly damaged, damp, musty or very dirty.

Red Kafir—No. 1 shall be pure red, of choice quality, sound, dry and well cleaned; No. 2 shall be seven-eighths red, sound, dry and clean; No. 3 shall be seven-eighths red, not dry, clean or sound enough for No. 2; No. 4 shall be seven-eighths red, badly damaged, damp, musty or very dirty.

Mixed Kafir—No. 1 shall be mixed, of choice quality, sound, dry and well cleaned; No. 2 shall be mixed, sound, dry and clean; No. 3 shall be mixed, not dry, clean or sound enough for No. 2; No. 4 shall include all mixed, badly damaged, damp, musty or very dirty.

Milo—No. 1 shall be mixed, of choice quality, sound, dry and well cleaned; No. 2 shall be mixed, sound, dry and clean; No. 3 shall be mixed, not dry, clean or sound enough for No. 2; No. 4 shall include all mixed, badly damaged, damp, musty, or very dirty.

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